Vol 43 JULY, 1949 No. 1

NATIONAL FIRE PROTECTION ASSOCIATION

Quarterly

Published Quarterly at Boston, Mass,, by the
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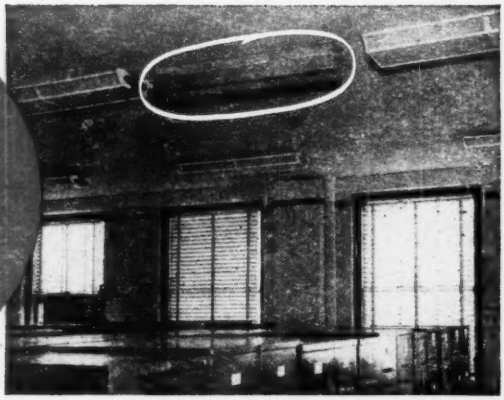

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QUARTERLY

of the

NATIONAL FIRE PROTECTION ASSOCIATION

60 Batterymarch Street, Boston 10, Mass., U. S. A.

Vol. 43 July, 1949 No. 1

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Accounts of fires appearing in the Quarterly are copies of or extracts from reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.

Indexed by Engineering Index, Inc.

Subscriptions to the QUARTERLY are accepted only as a part of the general publications of the Association which are sent to members. Associate membership is open to anyone interested; annual dues $12.50, of which $5 is for subscription to the QUARTERLY.

Entered as second-class matter December 15, 1928, at the Post Office at Boston, Mass., and Framingham, Mass., under act of March 3, 1879.
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Wide World

An exploding 2000-barrel asphalt tank at an oil refinery in Perth Amboy, N. J., on June 23. This shows the result, in an explosion, where the top of a vertical tank is stronger than the bottom. If the top is relatively weak, it will let go and vent the pressure, usually without any disastrous consequences. Where the bottom fails, under pressure, there is the rocket effect shown in the picture. In this fire, fire fighters were showered with burning asphalt and four died.

Compliance with NFPA standards for oil tanks, as given in the Suggested Ordinance on Flammable Liquids, should prevent disasters of this kind. The company owning this refinery generally follows NFPA standards and has a relatively good fire record, but in this case, the refinery was an old one, only recently taken over from another company. There was no insurance.

The Quarterly

Vol. 43 July, 1949 No. 1

Meetings of Board of Directors

San Francisco, May 16, 1949

Present

John L. Wilds, President
A. H. S. Stead, Vice-President
Hovey T. Freeman, Secretary-Treasurer
C. W. Pierce, Past President
Richard E. Vernor, Past President

Malcolm S. Blake	R. D. MacDaniel
A. L. Brown	Frank C. McAuliffe
Hylton R. Brown	John A. Neale
Loren S. Bush	George Richardson
Allen L. Cobb	W. A. Ross
Jack Curtis	John W. Strohm

Also present were: Percy Bugbee, General Manager, Robert S. Moulton, Technical Secretary, and as special guest Franklin H. Wentworth.

Business Transacted

1. The report of the Chairman of the Board to the annual meeting was approved and Vice-President Stead was asked to present the report in the absence of the Chairman. The Board expressed its regret at the inability of Chairman Elliott to attend.

2. The report of Treasurer Freeman to the annual meeting was approved and a vote of appreciation to the staff for the form of the Treasurer's report this year was adopted.

3. The report of the Committee on Flammable Liquids on the amendments to the Oil Burning Equipment Standards was approved. (The text of the Amendments was published in *Fire News* for June 1949 and will be incorporated in the next printing of the Standards.)

4. A letter from President Thomas Evans of AutoFYRstop Company protesting the presentation of the report of the Committee on Vaporizing Liquid Extinguishing Methods was reviewed by the Board without action.

5. The Board voted to recommend to the Association the election of Harold L. Miner as an Honorary Life Member of the NFPA.

6. It was voted to enroll the NFPA as a sustaining member of the International Association of Fire Chiefs.

7. A question of committee procedure regarding the adoption of minor changes in standards was referred to the Committee on Technical Committee Procedure.

8. The General Manager reported on his contacts with the Advertising Council with relation to the possibility of a year-round advertising campaign for fire prevention and also reported on plans for regional meetings in the fall of 1949 to be held in Atlanta, Ga. and Buffalo, N. Y.

9. It was voted to hold the next meeting of the Board in Boston on Thursday, July 7.

Boston, Massachusetts, July 7, 1949

Present

John L. Wilds, President
A. H. S. Stead, Vice-President
Allen L. Cobb, Vice-President
Hovey T. Freeman, Secretary-Treasurer
C. W. Pierce, Past President
Richard E. Vernor, Past President

A. L. Brown	John Neale
Hylton R. Brown	H. E. Newell
T. S. Duke	George J. Richardson
J. E. Frederickson	W. A. Ross
John Kidde	W. W. Sampson
R. D. MacDaniel	

Also present were: Percy Bugbee, General Manager; Robert S. Moulton, Technical Secretary; Horatio Bond, Chief Engineer; Charles S. Morgan, Assistant to General Manager; Warren Y. Kimball, Engineer; James K. McElroy, Assistant Technical Secretary; George H. Tryon, III, Assistant Technical Secretary; C. I. Babcock, Engineer; and Melvin R. Freeman, Public Relations Manager.

Business Transacted

1. General Manager Bugbee reported a telephone conversation with the Chairman of the Board, George W. Elliott, who was unable to be present because of a medical consultation. The Board expressed regret and extended to Mr. Elliott best wishes for a speedy and complete recovery.

Election of Officers

2. Past President Richard E. Vernor was elected Acting Chairman in the absence of Mr. Elliott.

3. In accordance with the vote of the annual meeting, the following officers were elected: President — John L. Wilds; Vice-President — A. H. S. Stead; Vice-President — Allen L. Cobb; Secretary-Treasurer — Hovey T. Freeman; Chairman, Board of Directors — George W. Elliott.

4. The Advisory Committee for 1949-1950 was appointed as follows: George W. Elliott, Chairman; Allen L. Cobb; Hovey T. Freeman; A. H. S. Stead; Richard E. Vernor; John L. Wilds.

5. T. S. Duke and W. A. Ross were elected to complete the personnel of the Nominating Committee for 1950.

Meetings and Finances

6. It was voted to confirm arrangements for holding the 1950 annual meeting in Atlantic City, May 15-18, as reported by General Manager Bugbee.

Tentative arrangements for holding the 1951 annual meeting in Detroit, May 7-10, were approved as reported by the General Manager.

Tentative plans for holding the 1952 annual meeting in Montreal, May 12-15, as discussed by Messrs. Bugbee and Stead, were approved.

7. The Program Committee for the 1950 annual meeting was appointed as follows: George W. Elliott, Richard E. Vernor; John L. Wilds; and the General Manager.

8. Treasurer Hovey T. Freeman reported on the current finances of the Association. This report was accepted with congratulations to the Treasurer.

9. The Budget for 1949-50 as submitted by the Finance Committee was approved.

10. Plans for holding regional meetings in Buffalo, November 1-2, 1949, and in Atlanta, November 29-30, 1949, as reported by Messrs. Bugbee, Cobb, Sampson and Moulton, were discussed and approved.

Industrial Fire Brigades

11. Board Member W. A. Ross, Chairman of the Committee on Firemen's Training, reported the unfavorable recommendation of this committee on the pro-

posed industrial fire brigades project which had been referred to the committee by action of the Board at its meeting in January 1949. Discussion developed certain additional phases of this subject beyond those originally considered by the committee (for action see minute 12).

12. A special committee on Industrial Fire Problems was appointed as follows: A. L. Cobb (Eastman Kodak Co.), Chairman; M. S. Blake (Bethlehem Steel Corp.); T. S. Duke (Star Sprinkler Corp.); J. E. Frederickson (General Motors Corp.); John Kidde (Walter Kidde and Co.); H. L. Miner (duPont Co.); General Manager Bugbee. This committee was instructed to consider and report to the Board at a later meeting their recommendations as to ways and means through which the NFPA might render more useful and constructive service to industry in matters of fire prevention and fire protection, considering suggestions made by Mr. Frederickson in his address at the 1949 annual meeting and suggestions from other sources. It was voted to refer the proposed industrial fire brigades project (see minute 11) to this committee for further study in connection with their general deliberations. The Executive Office was also authorized to add to the personnel of the committee, subject to confirmation by the Board at its next meeting.

Fire Prevention Education

13. A proposal for a general fire prevention educational campaign to be conducted through the Advertising Council was approved in principle and the General Manager was instructed to proceed to solicit funds for this purpose and to proceed with contacts with the Advertising Council in this connection.

Citations

14. A plan for citations to members who have rendered distinguished service to the Association was approved and the Executive Office was instructed to proceed with this project, such citations to individual members to be acted upon by the Board in each case before issuance.

Technical Committee Matters

15. A plan to add a flammable liquids field engineer to the NFPA staff to serve as Executive Secretary of the Committee on Flammable Liquids, to investigate and make reports on fires involving flammable liquids, and to promote NFPA standards in this field, was approved, subject to the availability of adequate funds for the purpose. The Executive Office was authorized to solicit funds for the support of this project from the various groups of NFPA members immediately concerned.

16. The Committee on Technical Committee Procedure for 1949-1950 was appointed as follows: C. W. Pierce, Chairman; A. L. Brown; Hylton R. Brown; A. L. Cobb; H. E. Newell.

17. The Executive Office was authorized to submit to the Board for action by letter ballot proposed amendments to technical standards submitted by technical committees in accordance with the specific authorizations of the annual meeting.

The procedure of the Board in acting on technical standards in the name of the Association was discussed without action.

18. It was voted to confirm technical committee appointments in accordance with the list submitted with the agenda for the meeting and to authorize the Committee on Technical Committee Procedure to make further committee appointments prior to publication of the 1949 Year Book, subject to confirmation by the Board

at its next meeting. It was further voted to reappoint for the committee year 1949-50 all members of technical committees not otherwise mentioned except where committees are to be discontinued or members have resigned or have been inactive.

Communication

19. A communication from a member suggesting NFPA promotion of fire protection activities on the part of service clubs was read and the General Manager was instructed to inform the member that the Association has already secured cooperation from service clubs and would continue to develop this avenue of fire prevention activity in so far as found practicable to do so.

American Standards Association

20. In response to a request from the American Standards Association to its member bodies for an expression of opinion as to the desirability of federal incorporation of the A.S.A., the General Manager was authorized, in consultation with other members of the Fire Protection Group, to transmit to the A.S.A. the opinion that a federal charter is not desirable and that the A.S.A. should more appropriately continue under its present state charter.

War Planning

21. General Manager Bugbee discussed the possible establishment of a project for NFPA planning for more effective utilization of manpower in the field of fire protection in the event of another world war and was requested to make further report on this subject at a subsequent meeting of the Board.

THE WRONG DOOR

On Saturday afternoon, June 4, 1949, two employees under the direction of a foreman were unpacking goods in the Montgomery Ward warehouse in San Rafael, California, — an innocuous operation from a fire hazard standpoint as long as somebody saw to it that the packing materials were properly disposed of. This the foreman undertook to do when he detailed one of his men to burn the rubbish. Being new on the job and not having previously had the rubbish detail, the employee was instructed to proceed to the end of a certain corridor, go through a doorway and there he would find a place to burn. The employee was successful in "finding a place to burn"; when next seen he was racing back up the corridor closely pursued by a fast spreading fire that caused $350,000 damage before being controlled.

There were two doors at the end of the corridor, one to the outside where the incinerator was located, and the other a fire door to a paint spray room. As luck would have it, the latter was blocked open, so in he went, deposited the rubbish in a convenient metal enclosure with what looked like a smoke pipe in the back, and touched a match to it.

Fire apparatus arrived promptly in answer to an automatic alarm, but the unsprinklered one- and two-story wood frame structure was already beyond saving.

Fire Department Administration

By John H. Alderson,
Chief Engineer, Los Angeles Fire Department

Webster defines administration as: The act of administering public affairs; the act of managing or conducting public affairs. My observation, which admittedly is limited, is that most fire departments are poorly administered. I think there are very definite reasons why a great deal of inefficiency exists in the administration of public fire departments.

In the first place, a municipal fire department is non-competitive. It does not have the pressure or incentive of competition with another similar organization in the same community. It is extremely difficult if not impossible to compare the fire department of Los Angeles with the fire department of San Francisco. It is not at all like one grocer or one butcher or one service station man competing with another across the street.

In the second place, whether we like it or not, the system of municipal government in this country is a political system and inevitably the administration of fire departments is affected to lesser or greater degrees by political influence.

In the third place, the fire service, like most other governmental services, is affected by precedent. A man newly appointed or promoted to chief of the fire department is a fool if he attempts to immediately uproot, change or reorganize systems and procedures which have been followed for many years. It is entirely different from private industry.

In the fourth place, fortunately or unfortunately, the fire service in most communities is a glamorous service. We respond only to help and not to hurt people. Most people are grateful for this service. Few of them are in a position to judge whether the service was as competent and efficient as it might have been. Firemen and fire departments are praised more than they are condemned. Living in an atmosphere of praise and glamour does not lead generally to cold-blooded analysis on the part of the chief as to whether or not his service is as good as it should be.

Civil Service

Finally most fire departments are completely under some type of civil service. This means that in the final analysis the chief has little choice as to his personnel, his officers and his assistants. So-called personnel experts prepare and conduct examinations and the chief is handed a list of names with very little choice as to who he may choose for key positions. Generally speaking, under civil service no man becomes the head of a fire department unless he has served many years in the

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NOTE: This article was presented as a paper at the Fifty-Third Annual Meeting of the National Fire Protection Association, San Francisco, May 16, 1949. The author made the following introductory remarks:

"It is indeed a privilege and an honor to have the opportunity to appear as a speaker at an annual meeting of the National Fire Protection Association. All of us in the fire service recognize the fact that the NFPA has become indispensable and that it is the one outstanding organization of its type in this country.

"The subject — Fire Department Administration — is certainly broad if it is nothing else. The only worthwhile publication which to my knowledge exists on this subject is a book entitled "Municipal Fire Administration" published by the International City Managers Association, but written practically in its entirety by the staff of the NFPA. To those who are actually interested seriously in the question of fire department administration, I recommend this book, its reading and its study."

organization. He is already steeped in precedent within his own department. Generally when he is promoted to the position he finds every other position in the department filled. The chief's position is only one small cog in an intricate machine. When that cog is lifted out and a new one put in its place, every other wheel — every other cog — every other portion of the machine remains exactly as it was. The machine has been running in a certain manner for years. It tends to run in that manner for years to come. To change the trend, the direction, the speed, the efficiency by merely substituting one small part is extremely difficult.

To those in private enterprise I suggest careful thought to this problem before commenting on or criticizing the efficiency or inefficiency of the administration of municipal fire departments. Consider the position of a man in a private organization who might suddenly be made the president or general manager without the power to change one portion of the organization — one employee — one assistant — one foreman — one superintendent or one director. The only possibility open to him would be a slow process of salesmanship, of influence, of training the personnel which he found when he took office.

Let's admit that the administration of a public agency like a fire department is an entirely different and in some respects a more difficult problem from the administration of a private organization. Nevertheless, there is no reason why the administration should not be more efficient or why more fire chiefs should not try seriously to improve the administration.

Understanding With Superiors

In my opinion, the first and most important step toward the efficient administration of a fire department when a new fire chief is appointed is a complete understanding with his superiors whether those superiors are a board of fire commissioners, a mayor, a fire commissioner, a city manager or a city council. The first step should be to have a complete, honest and open and above board understanding as to whether or not the fire chief is to run his department or whether he is to be interfered with by his superiors and by politicians. If the chief does not have complete control of his department he cannot administer it with any degree of efficiency. If promotions, transfers, assignments and departmental policies are to be determined on a political basis, any forthright, honest and progressive man should get out. No self-respecting man wants to be the type of administrator who only draws his breath and his salary and acts as a stooge for politicians. More fire departments have been wrecked by interference of politicians than from any other reason.

Consequently, my first point is this: In the administration of a fire department, keep politics out — keep political influence out or get out as fire chief. If you do not, the end result will be inefficiency, disruption of the fire department, discredit to you and too frequently personal disgrace.

If you have assurance that you will not be interfered with by politicians, sit down, isolate yourself and study your responsibilities. Study the law under which you operate in your particular community. Analyze carefully and meticulously exactly what authority you have and what responsibility you have. In other words, be sure that you know what your job is. Having done this, plan a program to meet that responsibility. Do not depend entirely on your own judgment and your own opinion. Call in subordinates and frankly discuss your proposed program

with them. You will find that many have ideas which you have not thought of. You will also find that the closer you bring them to you, the more you will secure their support. Having laid out your program, put it into effect, but with a velvet glove. Firemen are steeped in precedent. They do not readily accept new ideas, new procedures and additional work. Sell rather than force. What your men do willingly is worthwhile. What they are forced to do is detrimental.

In putting your program into effect remember, every day and every night and every minute, that no organization will succeed unless the right person is in the right spot. A poor program, a poor organization, can be reasonably successful if men in key positions try to make it successful. No program, no organization can succeed, no matter how perfect it is, if the wrong men are in the wrong job and if they are trying to make it fail.

Flexibility of Organization

The average fire chief has very little to say concerning the choice of his subordinates for key positions. To some extent fire chiefs are to blame for this. They should, as far as possible under civil service restrictions, keep their organizations flexible. Let me give you an example. City A has not had a fire prevention bureau. The fire chief sells the city manager and council on the advisability of authorizing a fire prevention bureau. He determines that the head of the fire prevention bureau, and the city manager agrees, should be on the level of a battalion chief. There are at least two ways to approach this. The municipal civil service organization can conduct an examination for the chief of the fire prevention bureau. The examination may or may not result in the choice of the man the chief wants and may or may not result in the choice of the best man. Nevertheless, after the usual probationary period, that particular individual is definitely and permanently in charge of the fire prevention bureau whether the chief likes it or not. If the chief does not like it, his only alternative is to attempt to prove inefficiency before various types of trial boards which, believe me, is generally a very difficult thing to do. I do not have to go far to point to examples where this has been done and the chief of the fire prevention bureau is in a position to defy the chief of the department, to ignore his policies, to oppose him, to undermine him, to be disloyal and to disrupt the organization.

A much better approach would be to simply ask the city manager and council to create one additional position in the rank of battalion chief. Appoint one more battalion chief. From the group of battalion chiefs the chief of the department can detail or assign one man to fire prevention work. If he is unsuccessful, inefficient, disloyal or unqualified, the chief can then readily reassign him to a battalion and try another man. Avoid cementing officers in specialized jobs as you would avoid the plague. This applies to fire prevention, arson investigation, publicity work, personnel work or all other specialized functions of the department.

If the fire chief has been able to avoid interference in the administration of his department by politicians or political influence; if he has seriously and intelligently analyzed his problem and his responsibility; if he has laid out a program and discussed this with key subordinates and others who may be able to aid and if he has made every effort possible under the usual civil service system to keep his organization as flexible as possible, he still

has other grave and larger personal responsibilities.

Delegation of Authority

When he assigns a man to a responsibility, whether it is fire fighting, direction of the fire prevention activities of the department, arson investigations, publicity, maintenance of apparatus or any other function of the department, the chief must still remember the fundamentals of the delegation of authority and responsibility. Do not give a man a job to do and then attempt to do it for him. He will make mistakes — he will do the job in the beginning in a way which will not entirely please the chief. You do not whip the baby because it falls when it first attempts to walk. You pick it up, encourage it, stand it on its own feet and let it try again. The same principle applies to the administration of a fire department. Within the restrictions of civil service and public employment, choose the very best man you can for a particular assignment. Let him stand on his own feet. When he makes the first mistake, support him — encourage him — do not criticize too much. If you believe that the mistake is of such importance that it should be called to his attention, call it to his attention, but in the most friendly, cooperative and helpful manner. Do not be arbitrary. After all, he may be right and you may be wrong. Just because you are chief you are not infallible. Try to build the reputation of — "give and take; I can be wrong too; I may be wrong in this instance; try your way a little longer and if it doesn't work out, then let's try my way." I know from personal experience that this can accomplish miracles.

Know Your Job

No man can do a job unless he knows what that job is. How often we have heard in one way or another this statement from firemen: "If the captain or the chief or the boss would only let us know what he wants, we would be glad to do it. What does he want? Why doesn't he tell us?" Tell your subordinates what you want. Tell them in such a way that they can understand it and that there will be no question as to what you want. Tell them in the form of a concise, intelligent rule book. Tell them in the form of an adequate operating manual. Do not put them in the position of having to consult you on every new problem which may arise. Anticipate new problems and give them in writing your policies in the form of a rule book or an operational manual or both. In our department we have been reasonably successful by developing a rule book and an operation manual. The operation manual is particularly important as a guide to the officer who wishes to follow your policies, who wishes to do what you want done and who can use it as a guide as to broad principles which he may apply to the particular problems which he meets in his day-to-day operations.

If you are able to have an understanding from the beginning and are able to maintain that understanding to keep politics and political influence out of your department; if you have seriously and after mature consideration analyzed your authority, your responsibility and your job; if you have laid out a program to meet that responsibility; if you have sold that to your subordinates; if you have been able to keep your organization as flexible as possible under civil service and the American form of municipal government; if you have had the courage and intelligence to choose the best men in your organization for the particular jobs which have to be done; if you have had the moral courage

to make changes diplomatically and considerately when men do not work out in assignments given them; if you have been big enough to delegate responsibility and to support your subordinates in their decisions until and unless they very definitely and apparently are wrong either from misjudgment or deliberately; if you have the eternal patience of Job; if you realize that public administration is an entirely different problem from that of the administration of a private industry, you very possibly may be a successful fire department administrator.

Lift Your Eyes

Frankly, however, my personal opinion is that you will not be and you will not have been, unless you have lifted your eyes a little higher; unless you have looked beyond the immediate horizon of your department; unless you realize your position in the scheme of things in this country and in the world; unless you have said to yourself: "I am more than a fire chief, I am a part of the greatest and most daring experiment which has been made in the government of men since the beginning of time. I am a part of the democracy of the United States. I am a part of the experiment and example which is being offered to the world to follow. It is true that I am only one of thousands of fire chiefs in this country. It is true that in the eyes of my associates I am probably an insignificant public official." But unless you are able and willing to look beyond this and to secure an inspiration for your work, I do not think that you can succeed. Our type of government which is now pitted against other types of governments began at the grass roots in the town house meetings in New England many years ago. Our government will either succeed or fail, depending on the efficiency, fairness and justice of local government.

Alexander Pope, the English poet and philosopher, said several hundred years ago: "For forms of government let fools contest; whate'er is best administered is best."

Hitler sold the German people by meticulous and efficient administration of government at the town and city level. If our type of government and if our philosophy fail, it will fail because of the poor administration of government at that level which most closely affects the housewife, the husband, the child, the individual citizen.

I have no fear of those few people in this country who are tabbed as fifth columnists, communists, etc. If our type of government fails or is ever changed, it will be because the average citizen, the man next door, becomes completely dissatisfied, irritated, discouraged and disgruntled with the government which he meets day to day. The fire department is an integral part of that government which contacts the everyday citizen in his everyday life. How those departments will be administered will eventually have a conclusive bearing on whether or not the people of this country are satisfied or dissatisfied with our democratic form of government. I suggest to every fire chief and every potential fire chief that he lift his vision just a little above the administration of a fire department — the transfer of a fireman — the decision on a fire prevention notice — the question of unionism or days off or salary or political considerations — and consider himself as a part of government in this country and as an individual who will have eventually a material effect on whether or not your government — my government — and the system which we have all learned to believe in and to rely on will continue or will fail.

Associated Press

St. Anthony Hospital, Effingham, Ill., at approximately 12:10 A.M., April 5, 1949. Flames have enveloped an open wood stairway, trapping Rev. C. C. Sandon in his quarters on the second floor at the right.

The Tragedy of St. Anthony Hospital

By James K. McElroy,
Assistant Technical Secretary, NFPA

"Greater love hath no man than this, that a man lay down his life for his friends.—ST. JOHN 15:13

Fire at St. Anthony Hospital, Effingham, Illinois, on April 4, 1949, took at least 74 lives and caused many painful injuries. Those killed were patients, day old babies, oldsters spending their last days in the shelter of St. Anthony's, and hospital staff members. The fire of unknown cause, believed certain to have originated in a laundry chute extending to the top floor of the building, was first reported by telephone from the third floor at approximately 11:45 P.M., April 4, 1949.

Listed as a 100-bed general hospital, it was the only hospital available to those needing its services within a radius of 25 miles of the stable, God-fearing, county seat town of 8000 in central Illinois. Regardless of race or creed or economic status of the people of the community, all felt the medical and physical security of their hospital and its staff, which had consistently served them well since its dedication in 1876.

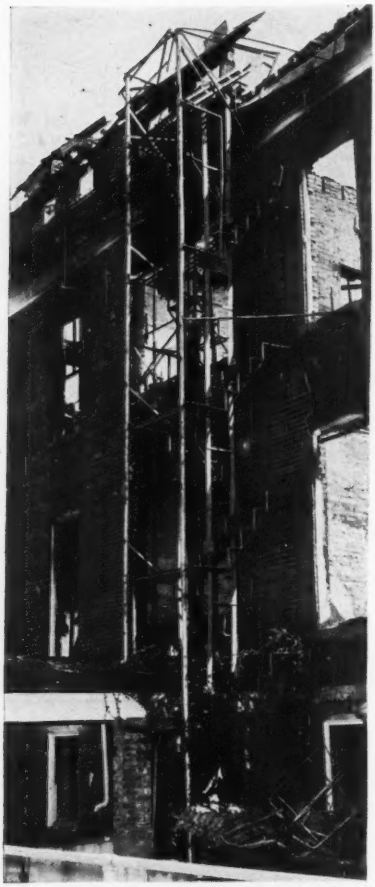
Within a few hours after the tragedy was reported, recently appointed Illinois State Fire Marshal Pat Kelly (formerly Deputy Fire Chief of the Chicago Fire Department), his deputies, building department officials from near and far, fire chiefs from large and small departments, representatives of the American Hospital Assn., the Illinois and the U. S. Public Health Service, the American Red Cross, Illinois National Guard, insurance adjusters, and hundreds of bereaved or curious converged on the scene. Two questions were on all lips, "What caused the fire?" (which will never be answered) and *"How could it have been prevented?"*

There is "nothing new" in the Effingham disaster but a rebuttal in lives to those who have long argued that comparatively low fire insurance costs and the presence of staff personnel in a hospital 24 hours of the day and night was a guarantee of the safety of patients regardless of the fire vulnerability of the construction of a hospital building or the lack of safeguards against the perils of destructive fire.

To sophisticated newspaper reporters, hardened to daily tragedy of lives lost in violent death by homicide, suicide and uncounted dead in fires in homes and apartments every year, the answer was a simple, "Nothing new!" Theirs the job to find the story that would keep the Effingham disaster on the front pages for the few days the public would accept it as news. Even arson in a hospital was not beyond their comprehension!

News reports stated, "The building was thought to be fireproof," and "—had its own extinguishing system." The first statement obviously a symptom of tragic over-confidence, unfortunately reminiscent of the LaSalle Hotel (61 lives), the Canfield Hotel (19 lives), and the Winecoff Hotel (119 lives), and other mass tragedies. The second statement was untrue.

As in every such tragedy, the ruins were searched for bodies and for clues as to the cause and the subsequent effect of the fire.



The exterior fire escape on the west side of St. Anthony Hospital. The nursery in which 11 babies and nurse Fern Riley lost their lives was located behind the double window at the second floor.

Identification and determination of the number of persons in the building was difficult, as all hospital records were destroyed in the fire. Survivors, grief-stricken or injured though they were, had to be questioned.

As in Chicago, Dubuque and Atlanta there was a fervent desire on the part of legal and other authorities to find the facts. Though "it did happen here" there was the same humble hope that through the reporting of the loss at Effingham, it would not happen somewhere else. Theirs the task to reconstruct the sequence of the destruction of St. Anthony Hospital, and ours to report it in terms understandable to hospital authorities in other towns and cities which would somehow move them to search out qualified advice from persons appreciative of the average hospital's economic situation, but with sound knowledge of the hazards to life and property from fire causes and their mitigation or elimination. The simple question which must be answered by all hospital authorities, and others deeply concerned with the safety of patients and hospital personnel should be, "How can we prevent an Effingham disaster in our own hospital?"

Evaluation of Hazards

In the light of the fire at Effingham, it is impossible to escape the conclusion that arrangements were not sufficient for prefire evaluation and correction of the existing hazards of unprotected vertical openings, the use of combustible interior finish, provisions for the detection and extinguishment of fire in the incipient stage. Thus, to avoid a recurrence of the disaster, hospital authorities, insurance companies and their representatives, architects, building department officials and fire department officials (all of whom have a stake in the proper evaluation of the possible maximum loss of life and property existing in any hospital within their jurisdiction and interest), should jointly consider and satisfactorily answer six basic questions in the determination of prudent corrective measures. All are interrelated, and a careful examination of each should result in a common-sense agreement as to corrective measures required. They are:

1. How combustible is the structure and interior finish?
2. What are the provisions for the limitation of fire spread (enclosure of stair wells, etc.) from any point of origin within the structure?
3. What provisions have been made for the discovery of fire in the incipient stage?
4. What provisions have been made for the immediate notification of fire-fighting forces and for the prompt notification of hospital personnel that an emergency exists?
5. What provision has been made for the prompt extinguishment of fire in the incipient stage?
6. What provision has been made for the prompt evacuation of patients to safe locations in fire emergencies?

Combustibility

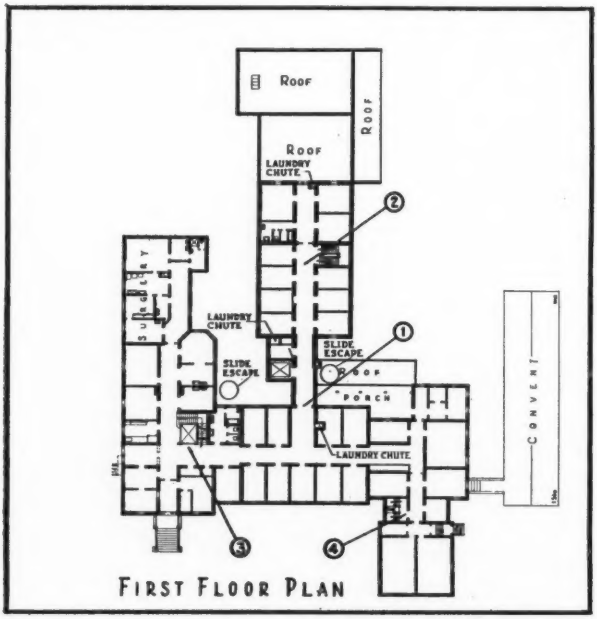
As the investigation proceeded at Effingham, the inherent combustibility of the structure was obvious, but the reason for the rapid spread of fire throughout the building less so. Early reports (in error) attributed the rapid fire spread to recent extensive painting and redecoration of the interior of the building.

The first 2½ story and full basement section was built in 1876. Brick and timber were cheap. Each room was separated by brick bearing walls. Its half-story (third floor) is reported to have had room separations of cellulose fibreboard on wood stud partitions (built at a later date). Accurate information as to the lay-out of rooms in the half-story is not available. In the original structure, three open stairways of wood construction extended from the basement to the attic, without fire doors or other protection provided for them. One of the stairways was later torn down and floored over. At the time of the fire the second open stairway (surrounding a metal lath and plaster enclosure for an abandoned elevator) also contributed to the spread of fire in the building. When built, the interior finish of the building was wood lath and plaster and the interior doors and trim were wood. The laundry chute (see plan page 16) in which the fire originated is not shown on plans made by a consultant architect in 1922 or as later revised, but is believed to have had a wood interior over a type of exterior plaster over cellulosic material. The exact construction at the top of the chute is unknown.

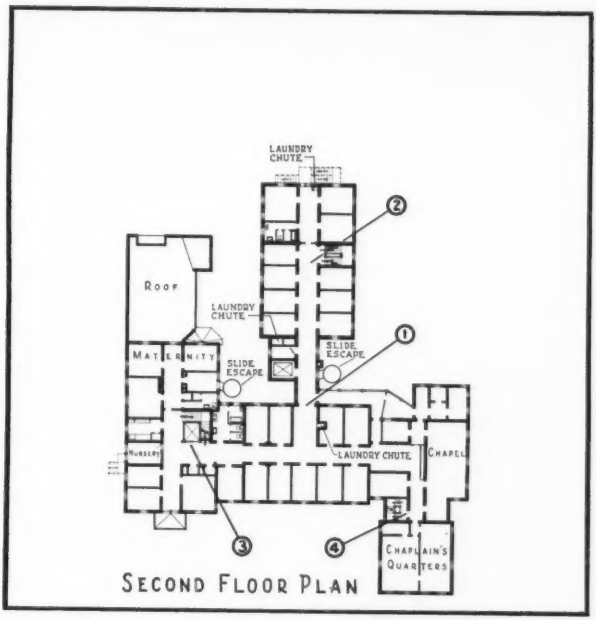
NFPA

The first floor west corridor looking south from the surgery. The ordinary glass and wood panel door delayed the spread of heat from the older section until firemen could bring hose into action. Combustible fibreboard acoustical material glued to metal lath and plaster ceiling in the surgery corridor scorched but did not ignite.

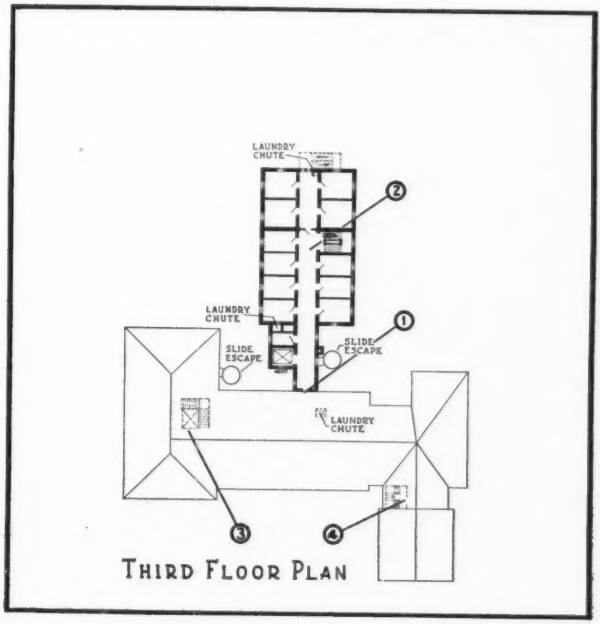
BASEMENT PLAN



FIRST FLOOR PLAN



SECOND FLOOR PLAN



THIRD FLOOR PLAN

Sun Times

The gutted ruins of St. Anthony Hospital, Effingham, Ill., looking east. The front entrance is in right foreground. The surgery is the one story and basement section left foreground. The top of one of the two slide escapes can be seen in the center. The north portion of the one story wood frame convent is visible in the upper center of the photograph.

In 1912 or 1913 a three-story, full basement section was added. It had brick walls, wood-joist floors, flat deck roof (with concealed space) and wood lath and plaster interior finish. Included in the design was an open wood stairway, without fire doors or other protectives, opening directly to the outside of the building between the first floor and the basement. The corridors of this addition were an extension of the corridors in the original building. A combustible laundry chute (exact construction unknown), shown on the plans made in 1922, extended from the laundry at the basement level to the third floor.

In 1924, a one-story and full basement surgery communicating with the section built in 1876 was added. The walls are brick, first floor construction concrete and terrazzo, and the flat deck roof is wood on steel joist. Interior finish is metal lath and plaster. Its corridor is an extension of the earlier building, separated by an ordinary panel door in an ordinary glass partition. (See cut page 15.)

The laundry and maintenance shop sections adjoining and communicating at the basement level with the three-story and basement brick, wood-joist section built in 1912, have brick walls and open wood-joist roof construction. The boiler room, next in rear of the laundry (and communicating with the maintenance shop through an unprotected door opening) is cut off from the laundry by a standard self-closing fire door assembly. The roof construction of the boiler room (like the maintenance shop, undamaged in the fire) is concrete on exposed steel beams. The laundry and its equipment suffered only superficial damage in the fire.

In agreement with a general policy established in 1925 by the Sisters of St. Francis, a 4-story fire-resistive elevator and utility room addition off the east corridor was constructed in 1945. A fire-resistive trash chute and laundry chute, only accessible at their lower extremities from the outside at the ground level, was included, and neither chute was involved in the fire.

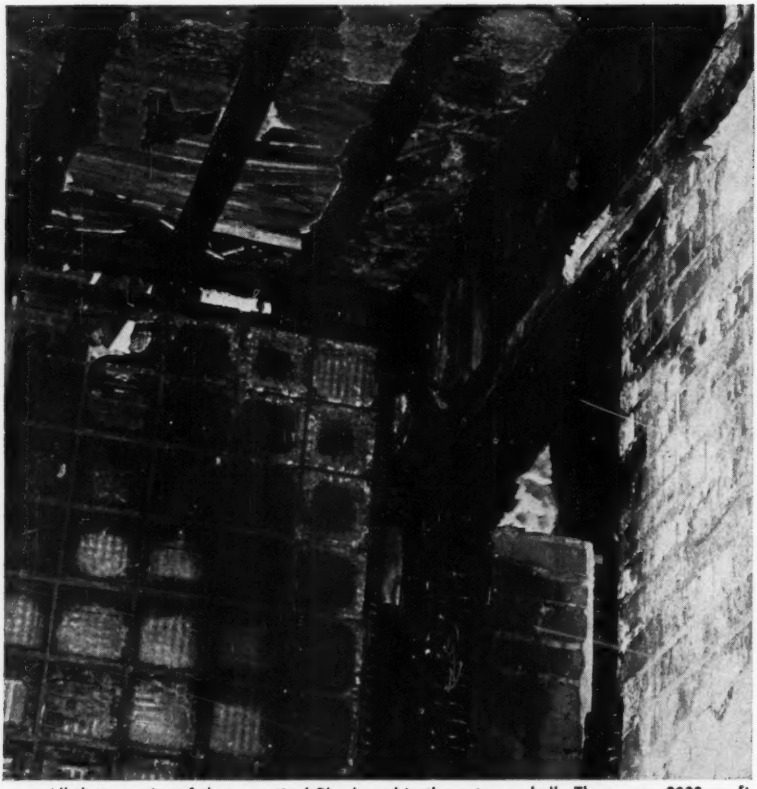
In 1943 the ceilings of the open corridors, except in the basement (approximately 350 lineal feet per floor), were sound-proofed with a combustible fibreboard acoustical treatment.* The side walls of the corridors, except for distance of 18 inches from the ceiling (acoustically treated), were covered with a type of oilcloth-like material.

Floor coverings, usually the last to ignite in any fire, are reported to have been linoleum throughout, except in the basement and surgery. They were waxed and polished.

In 1946 a one-story wood frame convent building, communicating through a passageway 16 feet in length with the basement of the main building, was built. The vertical exterior surfaces of this building were asphalt shingles (simulated brick appearance) which were scorched in the fire in the main building, but the efforts of the fire-fighting forces and the fire-retardant shingle roof covering combined to save this building from destruction.

A cursory examination of the ruins indicated that the possible maximum loss under completely adverse conditions was 100 per cent, especially in the event of fire

*The material used was a fibrous acoustical tile of the sort made by a number of manufacturers. Noncombustible acoustical tile and wall boards are also made by many of these same companies. Identical or similar trade names are used for both combustible and noncombustible boards so that the material is not identified by a trade name in this report. A number of these manufacturers are engaged in a program of development of fibreboards treated to reduce flame-spread characteristics.



All that remains of the acoustical fibreboard in the entrance hall. There were 9000 sq. ft. of this material in the building. Only that in the surgery remained after the fire.

originating in the maintenance shop, and had been so since its opening in 1876. The area of the building taken from the 1922 plans and measurements of the remaining walls, now rubble, follows:

Basement	19,000 sq. ft.
First Floor	15,000 sq. ft.
(Not including 2400 sq. ft. in the convent building.)	
Second Floor	13,400 sq. ft.
Third Floor	13,400 sq. ft.
Total Area	60,800 sq. ft.

Limitation of Fire Spread

Except for a standard fire door installation in the opening between the noncombustible boiler room and the laundry there were no planned barriers to the spread of fire in the building.

The usual special hazards found in hospitals—kitchen, laundry, storage room for general supplies, oxygen and ether storage, pharmacy and X-Ray laboratories,—were all located in the basement, not cut off in any manner from the balance of the building, but, like the LaSalle, Canfield and Winecoff hotel fires, none of the "special hazards" likely to be found in them were initially involved in the fire at St. Anthony Hospital.

The combustibility of one of the three laundry chutes which spread fire rapidly into the combustible attic (half-story) area, the open combustible stairways, and the use of combustible fibreboard in the attic and open corridor ceilings, all were major contributing factors in the large loss of life and the rapid and nearly total destruction of the property.

Discovery of the Fire

In the absence of automatic means or watchmen to detect the fire (which can be placed with reasonable accuracy in the laundry chute, see plan) dependence for discovery of the fire was placed on any one of 10 members of the hospital staff on night duty in the building. The exact time when Sister Eustasia first smelled smoke on the third floor of the east wing may never be known, but she is known to have telephoned Sister Anastasia, night superintendent, at the switchboard on the first floor. Sister Eustasia died in the fire and no one is alive who can trace her actions prior to or following her discovery of smoke at her duty station. Twenty-three patients in the third floor area (prior to 1946, the Sisters' quarters) also perished in the holocaust.

Emergency Notification

Organized fire drills had not been administrative practice at St. Anthony Hospital, which is not uncommon where a general feeling of security against fire exists. Sister Anastasia, at the switchboard (near collapse following the fire) remembers having rapidly telephoned Chief Engineer Frank Reis, who lived at the nurses' home 100 yards west of the building, Sister Superior Ceceliana at the adjoining convent building and the Effingham Fire Department. The approximate time Assistant Chief Charley Chamberlain, on night duty at the station, states that he received the call through the telephone office to the city hall was at 11:48 P.M. There were no time recording devices in fire headquarters.

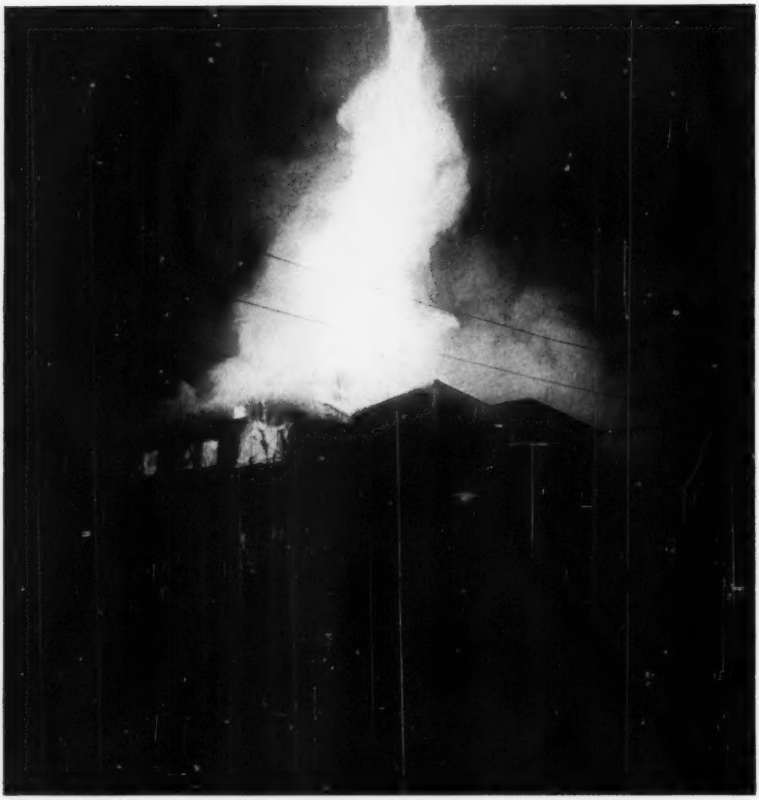
Wide World

The front entrance to St. Anthony Hospital, Effingham, Ill., following the April 4, 1949, disaster. Cribs from the second floor nursery piled to the right.

Extinguishment

Reconstruction of the sequence of events in the attempt to extinguish the fire until it was finally brought under control (approximately three hours later) is exceedingly difficult. Twenty-eight 2½-gallon soda and acid extinguishers and standpipe and hose were available to hospital personnel. Chief Frank Wilkins' department consisted of 22 men, six of whom are employed by local public utility firms.

The hospital chief engineer, Frank Reis, who died in the fire, raced from his home following Sister Anastasia's call, entered the basement entrance and to the opening into the laundry chute. He was last seen



Effingham Daily News

Shortly after the arrival of the Effingham Fire Department, flames were through the roof over the open stairway at the intersection of the south and west corridors. The nursery windows are those alight on the second floor; the St. Anthony Hospital office, records in ordinary steel filing cases totally destroyed, just below.

fighting the fire in the chute with a fire extinguisher, though he may have died in an attempt to reach his wife, who had entered the hospital a day or so earlier as a patient. Mrs. Reis later escaped by jumping from a third floor window and at the last report was near death.

Four discharged 2½-gallon soda and acid extinguishers were found in the rubble in the basement corridor near the opening into the laundry chute. (See plan page 16, extinguishers designated.) At least one was used in an effort to extinguish the fire at the chute in the first floor corridor. Several nuns, hurriedly dressing in the convent, entered the main hospital building through the passageway into the basement and assisted Engineer Reis until all were driven out of the building by smoke and heat rapidly filling the corridors, and the need to rescue patients became terribly obvious.

Assistant Chief Charley Chamberlain, driving the 500 gpm pumper, and one

member of the fire department arrived at the front of the building in approximately two minutes following the receipt of the alarm. As he braked to a stop, flames were seen in the second and third floor windows in the vicinity of the laundry chute originally involved, and patients were already at the second floor front windows screaming for help. Neighbors, nuns, nurses and the rapidly gathering crowd spread mattresses and helped with the movement of the ladder equipment placed at the front windows. Some patients were jumping to injury or death, when even a few seconds' wait might have enabled rescue.

Chief Wilkins arrived two minutes later, following a telephone call, in the same car with three members of the fire department. He immediately checked the fire escape at the rear of the east wing, and was shocked to find that no one was using it. Smoke was pouring through the entrance to the fire escape from the window at the end of the third floor corridor.

Eye-witnesses confirm the statements of members of the fire department that within a minute or two following the arrival of the first pumper flames burst through the roof in the vicinity of the open stair well at the intersection of the south and west corridors, and almost directly above the open stairway at the southwest corner near the nursery on the second floor. Later results confirm Chief Wilkins' statement, "We didn't have a chance!"

It is impossible to expect time factors to be accurately provided by any or all of those involved in mass destruction taking place before their eyes. It is believed that Assistant Chief Harry Stalling arrived within 5 minutes of the alarm with the department's 750 gpm pumper, adequate hose, 28-foot ladders and one 50-foot aluminum ladder. Two additional pieces of apparatus, and 500 gpm O.C.D. pump and a recently purchased and completely equipped rescue truck (panel body), were also prompt in arrival on the scene. Chief Wilkins estimates that all 22 men in the department and the available equipment were present within 10 minutes of the receipt of the alarm.

Firemen must expect critical comment from bystanders in the event of large loss of life fires, and the Effingham disaster is no exception. With the third floor of the building completely involved on arrival, Effingham firemen faced the same horrible choice many firemen have faced, whether to begin rescue operations (of paramount importance) or to lay their hose and get water on the fire. Many are alive who would certainly have died in the fire if rescue operations had not been the first choice of Assistant Chief Chamberlain and confirmed by Chief Wilkins on his arrival a minute or two later.

Reporters were quick to pick up comments and rumors about low water pressure at the hydrants and delay in getting water on the fire. It is considered that the water supply, pressure (45 lbs., boosted to 75 lbs.) and fire equipment available were sufficient to cope with almost any fire emergency except the insurmountable task the department faced at St. Anthony Hospital with fire through the roof of the building at the time of, or shortly after, arrival, open stairways, and open corridors finished with combustible fibreboard and without provision for automatic detection or extinguishment of fire. Fusible plugs on oxygen tanks stored in a room in the basement near the laundry chute let go during the fire and ether cans exploded, but the loss of life had already mercifully occurred in the opinion of competent observers.

Looking south. This slide escape serving the second and third floors of St. Anthony Hospital, Effingham, Ill., was not used to evacuate a single patient. The smoke and heat filled corridors made it impossible to reach escapes.

In response to a State Police radio alarm, volunteer fire departments from Matoon (28 miles), Neoga (15 miles), Sigel (8 miles), Alpamont (12 miles), Teutopolis (4 miles), and Salem (45 miles) each arrived with one engine company. Centralia (62 miles) sent firemen to the scene without apparatus. More than 50 firemen from these and other communities were continuously on duty for several days, digging out the ruins in an effort to recover bodies and searching for evidence which would indicate the cause of the fire.

Exit Facilities

The emergency evacuation of all patients under conditions which existed in the midnight fire at St. Anthony Hospital was impossible. Forty-two persons on the third floor, 29 on the second floor, and 3 on the first floor died in the fire. The combustibility of the structure and the rapid spread of fire on the surface of the interior finish in the open corridors combined with the open stairways to defeat the possible use of two exterior fire escapes (one at the end of the south corridor reached at the second floor through the nursery, and the other at the end of the east corridor) as well as two slide escapes (one accessible only from the east corridor, and the other through a room off the west corridor as indicated on the plans) installed on the order of the State Fire Marshal in 1940.

Consider the situation which faced the 10 members of the hospital staff on duty and at least two bed-side watchers (members of families) when they learned there

was a fire in the building (probably with the top floor half-story section at the front of the building totally involved), with more than 100 patients in their care, many in fracture casts, in traction splints, some recovering from major surgical operations, others aged and infirm, one blind patient, a prospective mother waiting in the delivery room, 11 babies (later to be identified only by the identification beads placed around their tiny necks), even some patients whose treatment had been completed and who were waiting the night to return to their homes!

At the very best, nuns and nurses asleep in the convent and nurses home who were familiar with the building, the location of the fire escapes and slide escapes, were from 3 to 5 minutes distant from their helpless charges, and the untenable stairways and corridors barred the way to them!

The heroism of survivors is ofttimes overlooked in the heroism of the dead, but Fern Riley, young nurse in charge of the second floor nursery, in the early stages of the fire had only to step outside the window of the nursery to the fire escape and safety, but died with her small charges facing certain death. Hundreds of proud fathers must have peered through the plate glass window at the end of the south corridor at their wrinkly new-born. The same window must have held terror to Fern Riley as she must have seen smoke and flames racing toward her through the 120-foot long open corridor and spreading down the open stairway from the third floor just outside.

Sister Eustasia, alone with her patients on the third floor died, as did Sister Bertina. Frank Reis, who knew every inch of the building, every pipe and fitting, every foot of electrical wiring, died in the fire. What a simple matter for Frank to have retreated to safety through the basement

Looking south at the fire escape at the end of the east wing which discharged to the roof of the laundry.

corridor, its paint bright and shiny even after the rubble cooled very much later.

Two special nurses died in the fire. They found the body of the hospital Chaplain, Rev. C. C. Sandon, trapped without warning in his second floor bedroom. At least one of the bed-side watchers is known to have perished. "Greater love hath no man than this—."

Neighbors, Sisters, nurses, firemen and other rescuers saved lives with heroism beyond compare. Fathers raced into the smoke and heat to save children and pregnant mothers until the quick burning structure drove them back. Several who jumped from windows, the only way out when the corridors became untenable, died of their injuries.

Without provision for the limitation of fire spread within the building, the fire escapes and slide escapes ordered to be installed by the State Fire Marshal could not be used to save a single life.

When the series of hotel fires in 1946 demonstrated the extremely high life hazard of unprotected vertical openings, the Illinois State Fire Marshal's office included the protection of such openings in the cor-

Esch

St. Anthony Hospital, a 100-bed general hospital serving the agricultural community of Effingham, Ill., as it appeared in January 1949.

rective orders issued to hotels and hospitals they were able to inspect under their jurisdiction, though this and other corrective measures are not specifically mentioned in the law.

At the last inspection by the State Fire Marshal at St. Anthony Hospital in 1944, the hotel fires had not yet occurred, housekeeping of the building was excellent, exit facilities were found to be in good order, and a recharge of the first aid fire extinguishers was ordered.

The death of 74 persons (49 women, 16 children and 9 men) of 128 now known to have been in the building at the time of the fire seems proof for all time that without adequate hospital personnel on duty trained to quickly move bed-ridden patients in their beds to areas of safe refuge or to adequate means of escape, loss of life is inevitable if areas subject to fire destruction are unlimited, there is delayed detection of fire and inadequate provision for the limitation and immediate extinguishment of it.

How Could It Have Been Prevented?

Recommendations for fire and accident prevention and protection to be acceptable must also be practical, and demonstrated from the fire record to be necessary to life and property safety. Recommendations beyond those indicated below could be made, such as, "Replace the combustible structure with fire-resistive construction."

No doubt such a recommendation would be desirable, but not immediately feasible from an economic point of view. The Sisters of St. Francis decided in 1925 to employ modern fire-resistive construction in the building of additions or replacements of their hospital facilities, and demonstrated their acceptance of this type of construction at this and other hospitals operated by the Order. The basic assumption in the following recommendations is that replacement of the structure was not feasible prior to the fire, and that the building could be used safely for many years if the recommendations and suggestions were complied with.

St. Anthony Hospital as it appeared to hundreds of bereaved and curious April 6, 1949.

Quite the most distasteful and frustrating task in the preparation of reports of large loss of life disasters for the membership of the NFPA and the public at large is the necessity for inclusion of items of omission and commission which in the aftermath can be seen to have contributed to the over-all result of the disaster. Distasteful, because such reports appear to "second guess" and frustrating for the reason that in each large loss of life fire in the past four years (273 lives in 4 fires) it has been obvious following each fire that there was over-confidence in the safety of the structure and occupancy which affected the attitudes of management, legal authorities, fire and casualty insurance interests, architects, building materials interests and others, prior to the fire. In all humility therefore, and in sequence insofar as the St. Anthony fire is believed to have progressed, the following recommendations for the limitation of fire spread in the building (and the estimated cost) might have been presented:

1. Provide a sprinkler head to be supplied with water from the nearest domestic service piping at the top of each laundry chute, trash chute and dumb-waiter shaft. Estimated cost $500.00.

   The exact cause of the fire is certain to remain unknown, but it is believed certain that it originated in one of three laundry chutes. Consider the effect on the loss of life had these chutes been protected by single automatic sprinkler heads.

2. Provide smoke barriers (as recommended by the American Hospital Association and the NFPA) in the east corridors at the locations indicated (1) on the plans. Doors to be arranged to be maintained in the open position unless closed by the operation of a heat-actuated device. Estimated cost $800.00.

   It is believed that the operation of doors in smoke barriers at the indicated locations would have cut off the passage of smoke and heat temporarily at the third floor level, and progressively lower, even though automatic sprinkler heads had not been provided for the top of the affected laundry chute.

3. Provide smoke barriers in first, second and third floors in the east cor-

ridors at the locations indicated (2) on the plans, and a standard self-closing fire door at the entrance to the east stairway in the basement. Estimated cost $750.00.

The design of this open combustible stairwell was such (completely destroyed in the fire) that it would have been physically impossible to enclose it at the entrances to it, except on the corridor wall in the basement. The recommendation for smoke barriers on the upper floors is the only feasible method of providing an enclosure without complete rebuilding of the stairway. It has the disadvantage of leaving one room on each floor opening into the open stairwell area, but this could be partially offset by providing a door opening into an adjoining room, or by the installation of a suitable door on the corridor opening into the room and depending on the fire department for rescue of individuals in these rooms. Providing adequate hospital personnel were available, patients could have been moved down such a protected stairway or to safety via the exterior fire escape at the rear of this wing.

4. Remove and rebuild the old elevator shaft and stairway at the location indicated (3) on the plan, the stairs to be constructed of noncombustible materials, the stairway enclosed with a minimum 1 hour partition, and the entrance doors to stairways at each floor to be Class B as listed by the Underwriters' Laboratories, Inc. Estimated cost $5,000.00.

In view of the rapid spread of fire in the half-story (attic of the south wing of the building) had the stairway been properly cut off and adequate staff personnel present, it could have been used for the evacuation of patients from the second and first floors. This stairway burned out and the metal lath and plaster enclosure collapsed into the basement in the fire.

5. Provide sliding fire door assemblies at each entrance to the stairway at the location indicated (4) on the plan. Estimated cost $600.00.

This stairway, enclosed except for the lack of fire doors, was totally burned out in the fire. A standard sliding fire door installation of the interior of the openings was feasible, and had they been installed might have saved the lives of patients and the Chaplain in the area. In addition, this stairway provided the nearest access to the upper floors for nuns resident in the convent.

6. Coat the fibreboard ceiling in all locations with fire-retardant paint equivalent to Albi-R (listed by the Underwriters' Laboratories, Inc.), or Fi-Re-Sist (tested for effectiveness by the National Bureau of Standards for the Corps of Engineers, U. S. Army) in accordance with manufacturers directions. Estimated cost $1,200.00. It is further recommended that future requirements for acoustical treatment be met through the use of noncombustible acoustical materials.

The fibreboard acoustical treatment provided for approximately 9000 sq. ft. of open corridors on the first, second and third floors was installed, using two methods: 1) fastened to 1 x 3 wood nailing strips beneath the original wood lath and plaster ceiling, and 2) by gluing it directly to the metal lath and plaster ceiling in the surgery. This material, once ignited, spreads fire much more rapidly over its surface than ordinary wood such as red oak. The cut on page 20 shows all that remained of the fibreboard in the corridors except that in the surgery. The charred wood nailing strips can also be seen in the cut on page 15, which shows the fibreboard in the corridor of the surgery, where the ordinary wood panel door and ordinary glass partition delayed the ignition of the board until fire-fighting forces could reach the area and prevent the glue from melting, which, had it done so, would have released the board from the ceiling.

Recommendations 2-5 above would limit the areas of the corridor subject to rapid spread of smoke and fire from the point of view of providing additional time for the removal of patients and would also enhance the effectiveness of the fire-retardant coating when applied to the acoustical material.

Fire Limitation — Summary of Cost Estimates:

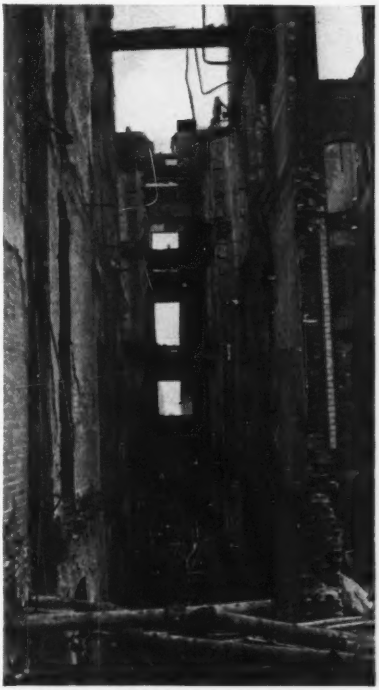
Recommendation 1....	$500.00
2....	800.00
3....	750.00
4....	5,000.00
5....	600.00
6....	1,200.00
Total....	$8,850.00

Automatic Protection

The primary consideration in the use of automatic protection devices is their contribution to the enhancement of the life-safety of the occupants. As has been indicated above, the first notice that there was fire in the building came from Sister Eustasia, who smelled smoke on the third floor. This discovery was in the line of duty, no watchman patrol charged with this specific duty having been provided. As both persons who might be able to answer the question as to the cause and time of origin of the fire died in the fire, it will never be known. Three days after the fire, firemen digging in the shadow of unstable brick walls, finally reached the floor level of the basement at the base of the laundry chute. Bits and pieces of charred linen from the chute burst into flame as the rubble about them was removed. Nothing was left in the rubble to indicate the cause of the fire.

It has been noted earlier that the areas of special hazard were not originally involved in the fire, but this is not to suggest that fire in such locations is an impossibility. On the contrary, the location of general storage areas, oxygen and ether storage, laundry, X-Ray rooms, the kitchen, and the pharmacy in the basement (especially without structural protection against the spread of fire vertically and horizontally from such areas) could have as easily been major factors in a holocaust in the absence of detection and extinguishment of fire in the incipient stage. On two earlier occasions, the Effingham Fire Department had handled fires (discovered by personnel and promptly reported while in the incipient stage) in laundry and maintenance shop areas without difficulty or unduly alarming the patients.

Thus, concurrently, action is necessary in limitation of fire spread in the building and consideration of the necessary automatic protection facilities. Whatever type of automatic protection is provided, means to automatically transmit an alarm to the public fire department (and the hospital fire brigade if available) without hospital staff interference is necessary, as is provision for assured maintenance of the automatic systems in operating condition.



Illinois State Fire Marshal

Looking north in the remains of the east corridor. The basement opening into laundry chute in which the fire originated was just to the south of the twisted piping.

Automatic Sprinklers

Automatic sprinkler protection is designed to detect and extinguish fire in the incipient stage, and thus serves two highly important purposes. Too little emphasis has long been placed on the life-safety value of automatic sprinklers, too much

on the considerable saving in building and contents fire insurance costs through their use.

Early newspaper reports stated that the "building had its own extinguishing system." This report was totally in error. Automatic sprinkler protection is reported to have been recommended.

Consider the difference in the result of the fire at the St. Anthony Hospital had structural limitation of the spread of fire and smoke been provided, the fire in the laundry chute detected and extinguished by automatic sprinklers, the fire department automatically notified, and the hospital personnel notified and trained to evacuate patients to safe locations.

A reliable cost estimate, based on presently available water supplies, for the installation of automatic sprinklers throughout St. Anthony Hospital with a water flow alarm connection direct to the Effingham Fire Department headquarters, is less than $25,000.

Automatic Fire Detection

There are many types of approved automatic fire detection systems listed by the Underwriters' Laboratories, Inc., and the Associated Factory Mutual Laboratories, Inc., any one of which, if properly installed and maintained throughout St. Anthony Hospital could have detected fire automatically in any location in the incipient stage, provided direct notification of the Effingham Fire Department, and warning to the hospital staff that there was a fire emergency requiring immediate action. Consider the difference in the result of the fire at St. Anthony Hospital had structural limitation of smoke and fire spread been provided, the fire in the laundry chute been automatically detected, the fire department automatically notified, and the hospital personnel notified and trained to evacuate patients to safe locations.

A reliable cost estimate made from the plans of the destroyed building for automatic fire detection protection of the entire building and a direct connection to the Effingham Fire Department headquarters is approximately $6,000.00.

Conclusion

The loss of 74 lives at St. Anthony Hospital* is not the result of willful acts on the part of any person or persons, rather it is the failure of all those familiar with the consequences to reach the Order of St. Francis with the advice which could have saved their grief and heartache and the lives of their patients and associates: the combination of combustibility of structure, its combustible interior finish, open corridors, stairways, and other unprotected vertical openings, and the lack of provision for the immediate detection and extinguishment of fire in the incipient stage.

To other hospital administrators the St. Anthony disaster is a tragic invitation to consider their own situation, and to follow qualified advice and assistance in the evaluation of the fire hazards, if any, present in their hospitals. A group evaluation should be made on the supposition that destructive fire may originate in any room or location within a building, whether in visible or concealed space, and in the light of available facilities for the detection and extinguishment of fire originating from any possible cause.

In the introduction of this report, the suggestion is made that advice and assistance in the evaluation process be obtained from those legally and professionally qualified to provide it. The list is repeated

*Property loss, direct and indirect, is expected to be in excess of $1,000,000.

with the type of experience likely to be available from each:

1. *The chief engineer of the hospital.* The chief engineer, responsible for the maintenance and operation of the hospital building and equipment, is best qualified to contribute his knowledge of the building and the location and condition of mechanical and electrical equipment. If a hospital fire brigade is to be set up, the logical person to head it, subject to the basic responsibility of the hospital ownership, is the chief engineer.

2. *The fire chief.* Regardless of the steps taken to improve the physical conditions in a hospital (or any other occupancy) the fire chief and his department will be called upon in a fire emergency, and he and his department must deal with conditions as he finds them when a fire occurs. The success or failure of the fire department efforts in the saving of lives and property in large measure is dependent on the *immediate* discovery of fire, the *immediate* transmission of an alarm to the department, the provisions made for the limitation of fire spread within the structure pending the arrival of the department, and the over-all vulnerability of the structure to fire destruction. Much of the fire department's effectiveness is dependent also on a complete knowledge of the building and the location of hazards and protective devices in it, as well as the availability and dependability of water supplies, etc. The fire chief, may, in addition, have legal responsibility for the enforcement of ordinances affecting the storage and handling of flammable liquids and gases, and other common requirements of fire prevention ordinances.

Thus, in the evaluation of the hazards of a hospital, the fire chief is in a position to make his contribution to the protection of the patients and personnel on the basis of his department's capabilities and advice as to fire drills, alarm transmission, etc. Building owners have often been helpful to fire department officials in securing manpower and equipment shown to be essential in the reasonable protection of their specific properties.

3. *The building department official.* In most communities which are subject to building code requirements, the building official is legally responsible for the enforcement of building regulations affecting the hospital. Such regulations often overlap with fire prevention regulations, but the basic legal justification for both lies

Looking west in the south corridor. The unburned flooring hangs from the remains of the floor of the nursery. The office was directly beneath; all records were destroyed.

Effingham Daily News

Front of the hospital at the height of the fire. Forty-two persons lost their lives on the third floor, 29 on the second floor, and 3 on the first floor in the midnight holocaust at St. Anthony Hospital, April 4, 1949.

in their protection of the safety of the public. In several states (as in Illinois) the State Fire Marshal and local fire department officials have permissive responsibility for the provision of safe means of egress, fire escapes, etc.

Thus, the building department representative in the deliberations of the group may be expected to contribute sound knowledge of the fire resistance of the structural elements of the building, legal requirements for exits, and should also be familiar with costs of various types of building materials found to be necessary. In addition, the legal implications of structural problems are usually the responsibility of the building official.

4. *The architect.* Few hospitals make physical changes in their buildings without the services of an architect. Fortunate is the hospital board whose architect has a basic knowledge and appreciation of the relative hazards of combustibility of building materials, the availability and comparative costs of various materials used for sound-proofing, requirements for exits, protection of openings, and other alterations commonly necessary. The architect will ordinarily be found to have the most up-to-date information of the evaluation group in the consideration of possible costs of making improvements.

5. *The fire protection engineer.* Fire insurance agents, brokers, and fire insurance companies they represent, like the owners of buildings, have a basic interest in the reduction of life and property losses from fire causes. Fire insurance companies do not indemnify the hospital owner or his employees for loss of life. The ser-

vices of fire insurance engineers obtained through the cooperation of company sales representatives, may be expected to make their principal contribution to the group evaluation of fire hazards in sound knowledge of the mitigation or elimination of the hazards, NFPA standards for their protection, and the hazards to life and structure from failure to protect vertical openings or to consider the inherent combustibility of the structure, interior finish, etc. Fire insurance engineers may also be expected to provide knowledge as to the effect of proposals for corrective measures on fire insurance rates.

6. *The casualty engineer.* Casualty insurance companies indemnify owners and employees against loss of life, accident, etc. The services of casualty insurance engineers obtained by contact with the appropriate agent or broker, may be expected to contribute a wider knowledge of the adequacy of exit facilities (see NFPA Building Exits Code) and an accident prevention program than fire protection engineers, but in most cases, their understanding of fire hazards (their elimination or protection) is less acute than that of the fire protection engineer. Unfortunately, fire protection engineers and casualty engineers seldom have an opportunity to consider jointly and to provide prevention advice to owners at the site. In organizing an evaluation group, the hospital administrator will do both fire protection and casualty engineers a great service by providing them with an opportunity to meet and work together in the solution of an obviously overlapping problem.

General Program

In the aftermath of the disaster at St. Anthony Hospital, Effingham, the outcry for more law to protect the lives of helpless patients is no less distinct than that following every national tragedy, and the clamor in some cases is warranted. However, in Illinois (even given perfect law) there are only 13 men in the State Fire Marshal's office available to inspect 218 hospitals located outside the city of Chicago. It thus appears obvious that in Illinois, at least, legal requirements are not sufficient to allay the fears of hospital authorities or the patients they serve. What then is the answer?

It seems clear that hospital administrators who wait for inspections by public officials will be doing themselves and their communities a disservice. Consider the probable national effect of an evaluation program as outlined above, in which all affected organizations, insurance agents and brokers and the organizations they represent, architects, public officials and others combine their manpower and special knowledge to alleviate delay in a hospital inspection program which, in many cases, will result in improved life and property safety. What more important program is there, than the protection of the lives of helpless patients and hospital personnel?

Acknowledgment

Special acknowledgment, for their on-the-scene assistance in the preparation of this report, is made to Illinois State Fire Marshal Pat Kelly, Asst. State Fire Marshal Geo. H. Anderson, Deputy State Fire Marshal Algy P. Appanaitis; Chief Frank Wilkins and Asst. Chief Charles Chamberlain, Effingham Fire Dept.; and Roy Hudenburg, American Hospital Assn.

Oregon Mental Hospital Fire

The presence of mind of a nurse in closing a door at the head of the basement stairs was a major factor in saving lives during the hospital building fire, Fairview Home, near Salem, Oregon, on May 18, 1949. This was a stubborn smoky fire in the hospital building of a state institution for mental defectives.

There existed within this building several structural weaknesses that could well have combined to produce another Effingham holocaust. That there was no loss of life can be attributed to the efficiency of hospital personnel, the presence of an automatic detection system, and the fortunate time of occurence, late afternoon, when patients were awake and several attendants were on hand to assist in evacuation.

Fire Marshal, Oregon

This door at the head of the basement stairs stopped the draft and spread of smoke long enough to permit the fire to vent itself through the elevator shaft, thus keeping the corridors reasonably free of smoke for some seven minutes while the patients were being rescued.

Construction

The 40-bed hospital building was a two-story structure with attic and basement, concrete outer walls, wood and plaster interior and a wood shingle roof. Important interior structural features included open corridors, nonfirestopped walls and pipe shafts, the undivided attic, and an unused elevator shaft in the center of the building extending from the basement to the attic and around which a stairway was constructed from the basement to the second floor. The elevator shaft was enclosed by wood lath and plaster with the exception of two sides in the basement enclosed by 1 by 8-inch boards, poorly joined. An ordinary panel door at the head of the basement stairs was the only barrier to vertical spread of smoke and fire through the stairwell.

Fire Protection

Outstanding among the private protection at this and the other institution buildings was the automatic fire detection system (rate of rise), which on activation sounded a warning signal in every building on the grounds and at the same time notified the switchboard operator of the fire location. The operator immediately relayed the location to the alerted personnel over the public address system and called the Salem Fire Department. Manual fire alarm boxes (5 in the hospital), standpipes with hose attached, and fire extin-

Based upon report submitted by Fire Marshal, Oregon, supplemented by observations by the editor at the scene.

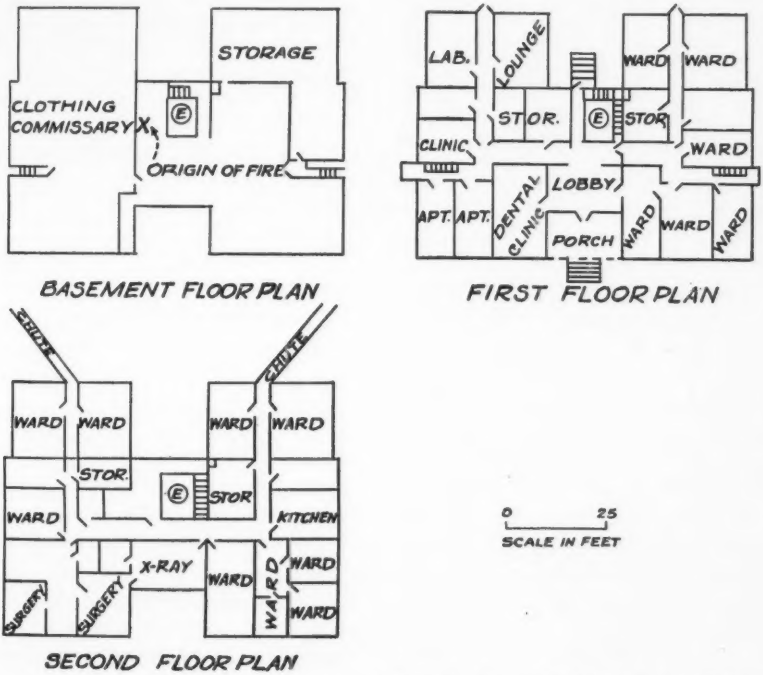
guishers completed inside protection.

Since the institution was located in an unincorporated territory, public fire protection and a public water system were not available and were therefore provided by the institution. The former consisted of a 250 g.p.m. engine for the use of a crew of employees, and the latter a 6-inch looped main (hydrants at 300-foot intervals) supplied from a 50,000-gallon elevated tank. The City of Salem had agreed to send fire apparatus when needed, and in case of emergency to allow water from the Salem feeder main that passed nearby to be diverted into the institution's mains.

The Fire

Shortly after 5:00 P.M., May 18, one of the four attendants on duty smelled smoke coming from the elevator shaft on the second floor. She proceeded to the basement to investigate, and on discovering fire on top of a pile of crated bed frames near the elevator shaft went back upstairs to give orders for evacuation. She was careful to close the door at the head of the basement stairs. An attempt was then made to telephone the alarm to the office, but burned wires prevented the call from getting through. However, notification had previously been given by the automatic alarm system and employees from nearby buildings were already on the way to help, the brigade was assembling and Salem had been notified to send apparatus.

Evacuation was fast and efficient. Thirteen patients (6 bedfast) were on the



Hospital building at Fairview Home, state institution for mental defectives, near Salem, Oregon.

Fire Marshal, Oregon

Fire in the basement of this hospital building extended to the attic through a poorly enclosed unused elevator shaft. Shortly after the 27 patients had been evacuated, smoke-choked corridors became impassable and could not be reentered until the fire had vented itself through the roof.

second floor and 14 (2 bedfast) on the first. Of these 27, 13 either walked or were guided to safety, one was carried out, three were removed through a first floor window, five were handed out of a rear hallway door and five were evacuated by means of two escape chutes installed at second floor corridor windows. These chutes were extremely valuable in the evacuation of the bedridden patients, although the task could have been greatly simplified had access been through doors instead of windows. There were no serious injuries, although near casualties occurred when a few confused patients reentered the smoke-filled building. One had returned to her room, but fortunately her absence was noted in time to effect rescue before corridors became impassable. As near as can be determined, the building was cleared within seven minutes. Throughout this period smoke gradually filled the hallways, but at a much slower rate than would have been the case had there been no door at the head of the basement stairs. Without this door it is doubtful if evacuation could have been completed successfully.

The fire, cause officially unknown, is believed to have been set by a disgruntled patient. It rapidly increased in volume, swept across the basement ceiling and into the elevator shaft through cracks in the enclosure and was racing up the shaft even before all the patients were evacuated. From the shaft it mushroomed into the undivided attic and prior to breaking through the roof worked down through the nonfirestopped openings between the outer concrete shell and the inside wood lath and plaster wall.

The institution's fire truck was soon joined by four engines, a water tanker, and salvage company from Salem, but early fire fighting was severely handicapped by the dense smoke. Since Salem's aerial lad-

der was out of service and ladders on the engines did not reach the roof, the building could not be ventilated and entry effected until sections of the roof burned away and released the pent-up smoke and gases. It was then possible to move in and commence the arduous task of extinguishing the flames that honeycombed the building, a four-hour job.

Salvage operations were instituted under the leadership of the Salem salvage company, and this prompt action, coupled with the efficient operation of the fire-fighting forces once they had gained entrance, is responsible for a salvage far exceeding the most optimistic expectations. Present estimates place the loss at $130,000.

Sprinkler Equipment Identification Signs

The National Automatic Sprinkler and Fire Control Association has secured, through industry-wide adoption, a uniform procedure for identifying sprinkler valves and alarms. These signs are designed to eliminate the present inadequate methods employed to label essential sprinkler control equipment which have been responsible for confusion under emergency fire conditions. Various individual and insurance-inspired efforts toward labeling of valves and gongs have not seemed adequate to accomplish the desired end, but this NASFCA move is a constructive effort to provide standard identification methods for all new equipment installed by their member companies.

The basic sign, illustrated on this page, is 9 in. wide and 7 in. long and is made of 20 gauge steel finished in synthetic baked enamel or 18 gauge steel finished in porcelain enamel, the latter to be used for outdoor installations. The background color is a fire red and the letters are a contrasting white. The 6 in. by 2 in. white space is for imprinting the location of the sprinklered area which the valve controls, i.e.: "In This Stairway"; "In This Section"; "In Elevator Bulkhead"; "On This Floor"; etc.

THIS VALVE CONTROLS
SUPPLY TO AUTOMATIC SPRINKLERS
MUST BE OPEN AT ALL TIMES
TO BE HANDLED IN CASE OF EMERGENCY ONLY BY AUTHORIZED PERSON OR BY EMPLOYEE CARING FOR SPRINKLER EQUIPMENT. WHEN MAKING REPAIRS GIVE NOTICE TO AND OBTAIN THE CONSENT OF —

By the use of these signs on a nationwide basis, the industry believes that maintenance personnel will become better acquainted with the equipment and thus utilize it to maximum advantage under emergency fire conditions. There have been cases where unnecessary damage has been occasioned because the users of sprinkler systems were not readily able to determine the location of shut-off valves and where passers-by have not recognized ringing exterior gongs as a fire alarm signal.

Further information on these signs may be obtained from the National Automatic Sprinkler and Fire Control Association at 205 East 42nd Street, New York 17, New York.

Hazard of High Piled Combustible Stock

By Norman J. Thompson,
Director, Factory Mutual Laboratories

The general subject of fire prevention and the hazards of high piled combustible stock is so broad a subject in itself that we cannot do any more in a short period of time than give it the most superficial treatment. It has been generally considered that arrangement of stock up to eight feet did not represent high piling. Stock over eight feet in height we have always thought of as high piled stock; and in general, we have considered sprinkler protection under conditions of stock in excess of eight feet up to possibly fifteen as "fair." For that piled over fifteen feet high the term is somewhat less complimentary.

We recently made an analysis of fires over a ten-year period to see what the losses were for fires in stock piled over 8 ft. high as compared to fires in stock piled less than 8 ft. high. For cotton storage (mostly cotton in bales) the average amount of loss per fire when cotton is piled from three to six bales high was about three times that in cotton piled one to two bales high. From a similar analysis of all types of combustibles we found that the ratio of average loss for stock piled over eight feet high as compared to that piled less than eight feet high was almost nine to one. Fortunately, there are certain characteristics of the combustibles which have been rather favorable. I refer particularly to storage of waste paper, various textiles, and bags of material such as coffee and sugar. In each case, because of the compact nature of the combustibles, access of air to the interior is quite limited, so that burning occurs mostly on the exterior surfaces. Therefore, even though the fire may be very persistent and hard to extinguish, the combustion intensity is of a relatively low order.

A few months ago our attention was drawn again to this question of protection of high piled stock because one manufacturer wished to palletize storage of automobile tires. Naturally he wished to make the fullest use of warehouse capacity, which meant piling to the maximum safe level. We ran test fires on tire storage at our station in Norwood, Massachusetts, and we were quite surprised at the intensity of the fires. These experiments brought to mind some tests which we ran several years ago on storage of cork in bales twelve to fourteen feet high. We were unable with ordinary sprinklers to put out the cork fire or to prevent its lateral spread, but in these tests which we ran on automobile tires the rate of heat liberation was considerably greater. The tire fires were more like fires in flammable liquids.

The tests on tires on wooden pallets presented such an unusual problem that we were immediately concerned in regard to storage of automobile tires as they are usually found today, piled on the floor. After several tests both on pallets and piled directly on the floor, we began to compare the results of tests in the two types of storage. While we were unable in the short time available to run enough tests so that we could evaluate the results exactly,

NOTE: This article was presented as a paper at the 53rd Annual Meeting of the National Fire Protection Association, San Francisco, May 16-19, 1949.

Figure 1.

it was obvious that for the same height of tires we had more difficulty in putting out the fires in tires piled on the floor than in the same height of tires piled in closely spaced pallets, in spite of the added combustible in the wood of the pallets.

Figure 1 shows a typical setup for a test in tires piled directly on the floor. There are about 450 tires in the pile; and the tires are piled solid 8 ft. high, 4 rows by 5 rows, with separated interlocking piles above. These interlocking piles are approximately 4 ft. high.

Figure 2 shows the type of fire which results with sprinklers on normal spacing and with excellent water pressure. The sprinklers were 10 ft. apart on centers under a smooth ceiling, with flowing pressures of 55 psi initially and no less than 33 psi at any time. The rubber distills and the gases burn just as in a flammable liquid fire. The flames are high enough to impinge on the ceiling at the 15 ft. elevation in spite of the sprinkler protection.

Figure 3 shows a view of the outside of our test building during one of the tests on tires. The view is typical. It gives some idea of the difficulty which might be encountered in manual fire fighting because of the smoke. With less than 500 tires, of which probably no more than a quarter were actually burning, the building is completely filled with smoke so that there is no visibility at all. This condition may be expected in approximately 10 minutes after operation of the first sprinkler.

Figure 4 is a time-temperature graph at the ceiling over the fire in tires piled solid to 8 ft. with scattered interlocking piles above. In this test pressure was maintained at 60 psi at the top of the riser. Eight heads opened, which dropped the pressure to 38 psi; and finally 17 heads opened which dropped it to 33 psi. No more sprinkler heads opened because there had been only 17 automatic heads installed.

The first sprinkler head operated in about 4 minutes, with others opening up to about 7 minutes, but the ceiling tempera-

Figure 2.

Figure 3.

ture continued to rise. When it reached 1500°F., it was certain that the fire was out of control; and the test was discontinued with extinguishment by a heavy application of water from an auxiliary spray nozzle system. This time-temperature graph is more or less typical of the conditions which may be expected with inadequate initial sprinkler protection.

We have run test fires under sprinkler protection in tires piled solid to 6 ft. high, 8 ft. high and 12 ft. high, — with and without interlocking piles above. We have made tests in tires piled neatly one above the other and also in tires piled so as to interlock tires at every tier. Tests of tires on wooden pallets were run with pallets one, two and three pallets high.

We have found that in order to bring about satisfactory control by sprinkler protection on fires in tires piled on the floor, the water discharge rate should approximately be 0.30 to 0.35 gal. per sq. ft. per minute for tires piled solid to 6 ft. high. For 8 ft. high piling, there is required about 0.50 gal. per sq. ft. per minute; and for piling to 12 ft. high in the neighborhood of 0.80 gal. per sq. ft. per minute. There is some margin of safety in these figures, but the margin is not excessive, considering all of the possible conditions which may not be favorable.

The height of solid piling appears to be the determining factor, since the effect of scattered interlocking piles is secondary. When tires are piled with spaces between the vertical rows, the increased access of air brings about more intense combustion and requires more protection. Since sprinkler distribution is not so good at levels close to the ceilings, the protection will be better under high ceilings with more clearance between the ceiling and the top of the pile than in a space with low headroom and a lesser clearance.

Based on the tests which we have made on fires in tire storage, it appears advisable to stress the importance of good water discharge rates, — particularly for the first few sprinkler heads to open. In this type of fire, if there is insufficient discharge expressed in gallons per sq. ft. per minute to hold the fire with the first eight or

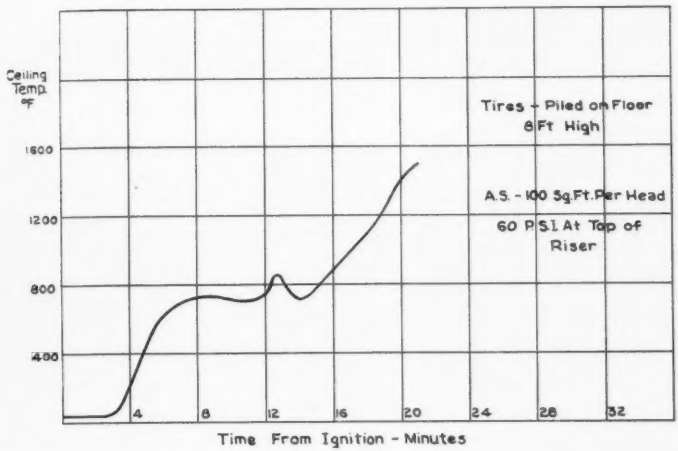


Figure 4.

dozen sprinkler heads, then the fire will spread laterally, producing a greater amount of heat and opening additional heads. As more heads open, the rate of discharge in the original location decreases rapidly because of friction loss in the piping; and unless conditions are such that additional protection by hose streams can be applied effectively to the burning tires, the only final outcome would be a total loss of building and contents. It is impossible to supply through a normal pipe schedule 100 sprinkler heads or more and at the same time maintain flowing pressures to give the necessary water discharge rates over the fire.

In every test which we have run so far, the fire could have been handled very nicely with not over 500 gallons per minute if the sprinkler spacing and pressure had been such as to give the required discharge rate in gallons per sq. ft. per minute over and immediately around the fire zone. This would indicate the advisability of a limited automatic high pressure supply combined with proper sprinkler spacing for the protection of this type of storage.

Before leaving the subject of tire storage protection, it is desired to point out that it is extremely difficult either with tires piled on the floor or on wooden pallets to make effective use of hose streams beyond the outside row of tires. In fighting a fire manually in a large pile, the effectiveness of hose discharge on the second row on the inside of the pile is considerably diminished, and inside of the second row manual fire fighting is most ineffective. It is necessary to move or tear down the exterior rows in order to get at the fire. Considering the interference to manual fire fighting in a large quantity of tire storage because of smoke and limited aisle space, it is essential that the fire brigade reach the fire as soon as possible after its outbreak while the fire area is still relatively small and before visibility has been too greatly impaired.

After running several tests in tires on wooden pallets and in tires piled directly on the floor, it was apparently somewhat easier to handle fires on pallets than the fires without pallets. For the same actual height of tires, there is more combustible because of the wooden pallets and the

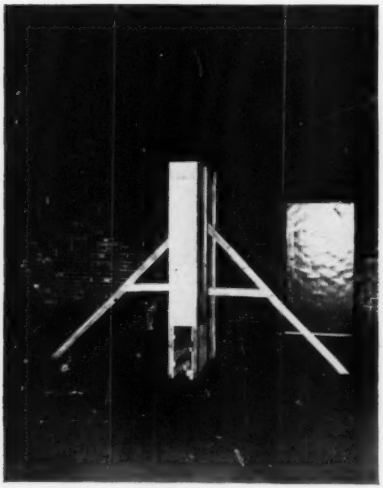


Figure 5.

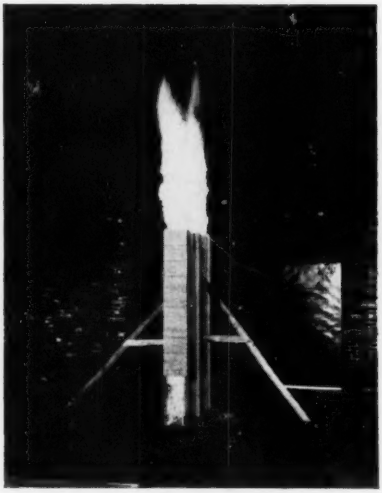


Figure 6.

total height is also somewhat greater. It was necessary to get back to fundamentals and to analyze the effect of various factors on fire intensities. We all know that fires in cotton storage and in many other materials are very persistent and may be difficult to extinguish, but the intensity of the fire in terms of Btu. liberation per sq. ft. of floor area is very much lower than was exhibited in our tire tests. We decided tentatively that the principal difference must be in air supply.

Several years ago we made some experiments in an investigation of spontaneous heating and ignition, and discovered an interesting figure which is oftentimes useful. We found that for all ordinary combustible material, whether in an intermediate oxidation or in the final stage of combustion, the heat which can be liberated depends solely on the rate of consumption of oxygen. The actual heat produced will be approximately 535 Btu. per cu. ft. of oxygen regardless of what is burning, whether it be soap, tires, wood, flour or petroleum. It is undoubtedly fortunate, particularly for fires in most combustible storage, that the intensity of any fire is limited by the physical arrangement of the combustibles so that the exterior surfaces only have a sufficient air supply to burn vigorously.

We next set about to plan a series of tests to give us significant information in regard to piling height and to arrangements which would permit more or less access of air. We tried to simulate a short section of the space which might occur between heavy packing cases piled up on a warehouse floor.

The test structures consisted of parallel vertical panels of spruce boards of moisture content around 10 to 12 per cent. The panels were supported on exterior vertical wood studs. The panels themselves were 4 ft. wide and of varying heights and fitted with interior wooden cleats staggered at various heights. The ends of the 4 ft. panels were closed in

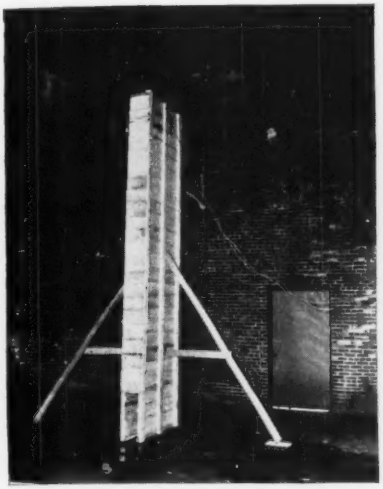


Figure 7.

Figure 8.

in every case by spruce boards except the lowest 2 ft. of height. Figure 5 shows a photograph of one of these structures with a total height of 8 ft.

Figure 6 shows the type of fire which will result after ignition by the use of a standard igniter on the floor, consisting of absorbent wood cellulose soaked with gasoline. At times flames issuing from the top of this structure reached a height of about 17 ft. above the floor.

Figure 7 shows another structure identical except that the height is 16 ft. The structure reaches almost to the concrete beams which are 17 ft. above the floor.

Figure 8 shows the resulting fire with a flame which almost reached the roof of the building which is approximately 33 ft. above the floor.

In the first series of tests with parallel panels, the spacing was kept at 8 inches and the height was varied from 4 ft. to 16 ft. The results are shown graphically in Figure 9. The temperatures given are the average of all ceiling thermocouples in the high section of our test building, which is 40 x 60 x 33 ft. high. On the right-hand margin of the figure are shown the corresponding rates of heat liberation in Btu. per minute. There was only a slight increase in ceiling temperature with the 4 ft. high structure. Even with a structure 8 ft. high, ceiling temperatures were only sufficiently high finally to open ordinary sprinkler heads. With the 12 ft. high structure, the heat liberation was considerably increased, and with the 16 ft. high structure the combustion intensity was almost 9 times as much as for the 8 ft. high structure. By way of explanation, the figures shown for "Btu. per minute" were determined by burning gasoline at various measured rates and noting corresponding average ceiling temperatures.

Since the heat produced from the 12 ft. high panels, for example, was from a burning area only 4 ft. by 8 inches in cross section—slightly less than 3 sq. ft.,—it is obvious that the normal amount of sprin-

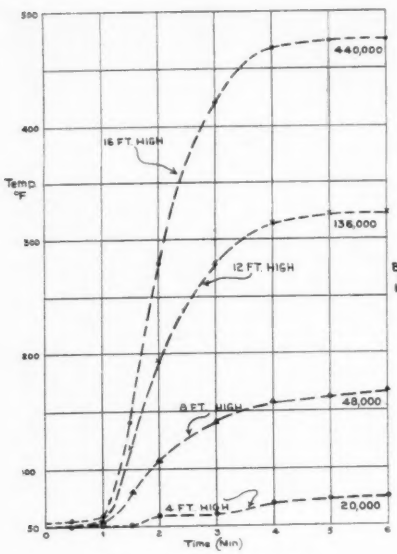


Figure 9. Effect of Elevation.

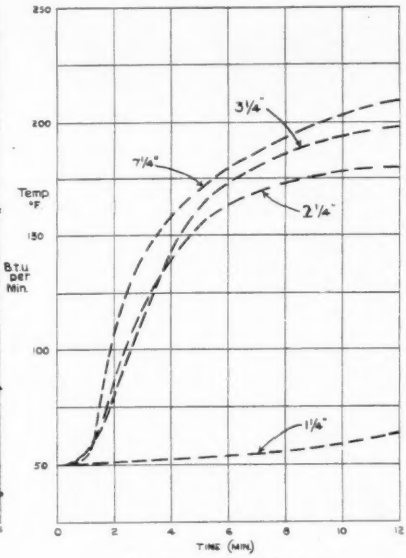


Fig. 10. Effect of Spacing.

kler water to fall within such a space would be inadequate to cope with the heat produced. Assuming a sprinkler discharge of 0.50 gal. per sq. ft. per minute, there would be available only about 4000 Btu. heat absorption capacity per sq. ft., whereas the heat liberation from the 12 ft. high panel was nearly 45,000 Btu. per minute per sq. ft. From this it should be apparent that ineffective sprinkler action in the case of high piled stock is not only due to interference with the sprinkler distribution, but is due to the lack of cooling capacity of the sprinkler water as compared to the heat liberated from the fire.

In the next series of tests we maintained the height of all structures at 8 ft., but varied the spacing between the parallel panels from 8 inches down to 2 inches. Considering the staggered ¾-inch thick interior cleats, the actual clear inside passageway varied from 7¼ inches down to 1¼ inches. When the panels were spaced 2 inches apart with 1¼-inch clear passageway, the fire intensity was very low, as can be seen readily from the graph, Fig. No. 10. However, as the spacing was increased, the fire picked up more rapidly.

In Figure 11 are shown comparative results of fires in two 16 ft. high structures, one with 7¼ inches clear space and the other with intermediate board baffles at 4, 8 and 12 ft. heights, the baffles being placed to obstruct the entire interior except for about ¾ of an inch. The effect of these baffles was to reduce the intensity of the fire until the baffles themselves were finally burned out successively.

In Figure 12, we have attempted to show the results of tests in which spray nozzles were used at the ceiling in place of sprinklers. An attempt was made to turn on manually the open spray nozzles at the time when sprinklers would have operated. The spray nozzles were used because

we could not get the same distribution of water at the various levels with ordinary sprinklers. The water density from the spray nozzles was adjusted at 0.25 gal. per sq. ft. per minute.

The ceiling temperatures shown with the water flowing appear quite moderate, but the temperature drops rather slowly in spite of the better cooling action of the spray nozzles as compared to sprinklers. When it is considered that our test structure was only 4 ft. wide and represents a very small sample of the area which might become involved in a warehouse with goods in wooden boxes or cases, it is very easy to imagine for any quantity of such goods piled to heights in excess of 8 ft. that a large percentage, if not all, of the sprinklers in the area would be opened with successively reduced protection per sq. ft. of floor space.

After having substantiated some of our ideas with the vertical parallel panel tests, we went back to tires again to see if we could not apply some of the principles effectively to the latter. In our opinion, the difficulty with the protection of tires was due to the fact that heat was being produced in such quantities per unit floor area that the discharge from sprinklers at any reasonable rate was hopelessly inadequate to absorb the heat produced. Consequently, we went to work in an attempt to cut down the fire intensity even at the risk of detracting somewhat from the effectiveness of the sprinkler distribution.

Three tests were run with tires piled on the floor to a solid height of 8 ft. with intermediate horizontal baffles of 5/8-inch thick plywood at the 4 ft. level of height. In the plywood we first drilled 3/4-inch holes 9 inches apart on centers, and in a later test drilled the holes 6 inches apart on centers. Moreover in the first test, the

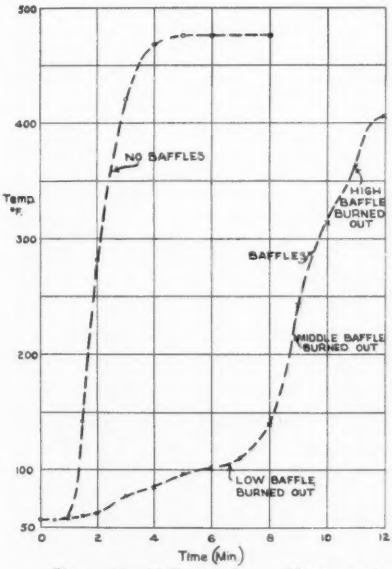


Figure 11. 16-ft. panels — 7¼-in. spacing. Effect of baffles.

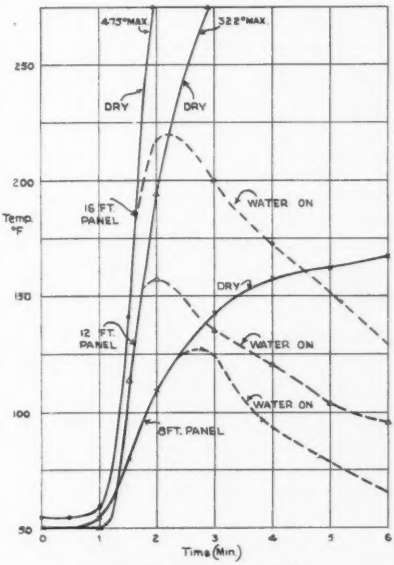


Figure 12. Effect of sprinklers.

individual plywood baffles (4 ft. x 8 ft.) were separated 5 or 6 inches apart, whereas in the third and final test the plywood baffles were butted so as to leave practically no space.

In tests with tires under a 15 ft. high ceiling with the plywood baffles, we were able to control the fire with 55 psi at the top of the riser, opening only 6 heads. The flowing pressure at the heads was 38 psi and the average calculated water coverage was 0.35 gal. per sq. ft. per minute. This is markedly superior to the protection afforded in fires in similar piles without the baffles, — such as is represented in the graph, Figure 4.

We ran other tests with tires piled solid to 8 ft. high underneath a 33 ft. high ceiling. With spaces between baffles and the holes 9 inches apart on centers, the fire was controlled very nicely with 11 sprinkler heads at a flowing pressure over the fire of 23 psi, or an equivalent average water coverage of 0.27 gal. per sq. ft. per minute. With the same type of piling, but without baffles, the lowest discharge density capable of satisfactorily controlling the fire was 0.41 gal. per sq. ft. per minute under the same 33 ft. high ceiling.

There was a noticeable difference in the fires underneath the baffles, as compared to piles with no baffles. The fire spread initially from the small ignition source as usual and soon gave rise to small tongues of flame passing up through the holes in the baffles. Then, as the fire below the baffle seemed to have an insufficient air supply, there was a considerable amount of smoke and fume issuing laterally from the pile below the baffle. As soon as sprinklers operated, the fire in the tires above the baffle was quickly quieted down, but persisted below. However, the intensity of the fire below the baffle was so reduced that there was no lateral spread and in a few minutes the smoke was dissipated by the sprinkler discharge so that the pile of tires could be approached for manual fire fighting with little difficulty.

One of the problems of the warehouseman is to keep the weight of upper tires from flattening and distorting the bottom ones. Some manufacturers in order to prevent damage to the tires move them and repile them frequently. If the tires could be piled 4 ft. high and left for 90 days or more without damage, then plywood or other horizontal panels could be used, supported from the floor with fibreboard cylinders. The second plywood panel at possibly a 7 or 8 ft. height could be supported in turn on fibreboard cylinders resting on the lower baffle. In this way, no tire would be carrying any more weight than the 3 to 3½ ft. of tires above it. We have found at Norwood that we can pile tires very quickly and easily using the plywood baffles, but the tire manufacturers themselves will have to determine whether or not this general method is practical in view of their particular conditions. At any rate, by this scheme or some variation of it or by the use of specially constructed pallets to produce the same effect, we are hopeful that we will be able to solve what appears at the present time to be a rather critical problem from the loss prevention standpoint.

Safety of Life from Fire at Sea

Report of International Conference

By Lt. Comdr. Donald V. Reardon, U. S. Coast Guard

Reaching a satisfactory agreement at an international meeting during these times is apt to be somewhat of a task. While I do not wish to imply that at the 1948 International Conference on Safety of Life at Sea there was no difference of opinion on many subjects requiring considerable debate among the delegates and many concessions by the various nations represented before a satisfactory compromise was reached, I do believe that this conference achieved more of its objectives than is common to most meetings of this type.

The conference, which convened at London in April, 1948, was the third such international meeting to be held by the leading maritime nations of the world. Like its predecessors, its purpose was to promote higher standards of safety on merchant vessels engaged in international voyages. Although the earlier conferences had given cursory attention to the subject of fire control and fire protection, this was the first to give it the consideration which is logically due to so vital an issue in the over-all scheme of safety of life at sea.

Before discussing in detail the accomplishments of this convention, I believe it may be interesting to mention briefly a little of the background of events leading up to these conferences. The first, which was held in London, England, in the spring of 1914, was called at the suggestion of the Congress of the United States, following the sinking of the British liner *Titanic*. Nearly 1500 lives, many of them American, were lost when that vessel struck an iceberg in the North Atlantic on April 15, 1912. With this particular disaster in mind, it was perhaps only natural that the representatives of the sixteen countries assembled gave primary consideration to ways and means of preventing a repetition of the *Titanic's* fate. Consequently, the principal topics discussed concerned the formation of a North Atlantic Ice Patrol, the compulsory use of radio, minimum standards of hull subdivision, life-saving appliances, and the recommendation of the use of fixed routes on the North Atlantic run. Very little thought was given to the subject of fire protection, although most certainly fire has always been one of the great perils of the sea.

The outbreak of the First World War prevented the 1914 Convention from coming into force, although parts of it were enacted nationally. Following the war, plans were made to hold a second conference to carry forward and expand the work commenced in 1914. Much knowledge had been gained during the intervening fifteen years, and with a basic framework already established upon which to build, a great deal of preparatory planning and research for this proposed meeting was undertaken, both in the United States and abroad. Delegates from eighteen countries convened in London in April 1929. Among the U. S. delegates was the late S. D. McComb, then chairman of the NFPA Marine Committee.

NOTE: This article was presented as an address at the 53rd Annual Meeting of the National Fire Protection Association, San Francisco, May 16-19, 1949.

At this convention, also, the major emphasis was again placed on watertight integrity, radio, life-saving equipment and safety of navigation, but the foundation was laid for what was to become a comprehensive and effective means of preventing major conflagrations on shipboard. The provisions relating to fire control as adopted by this convention, and as ultimately accepted by forty-three nations, were a step in the right direction, but were incomplete and inadequate as regards structural fire protection. Nevertheless, the requirements relating to fire hydrants, fire hose, portable fire extinguishers, fixed extinguishing and detection systems have proved to have been well conceived. These items required comparatively minor modification in 1948, in the light of the experience gained during the past twenty years.

As far as construction is concerned, the 1929 Convention simply provided that passenger ships should be fitted above the bulkhead deck with fire-resisting bulkheads, capable of preventing the spread of fire for one hour. Spacing of these bulkheads was limited, in general, to not more than 131 feet apart. The theory was that a fire originating in a compartment between two such fire screen bulkheads could either be brought under control before spreading to an adjacent compartment, or would burn itself out without jeopardizing the remainder of the vessel. The inadequacy of these so-called *main zone bulkheads* by themselves to prevent a major fire on a large passenger vessel was demonstrated in the years that followed the signing of the 1929 Convention by a series of disastrous fires. The loss of the *Asia* in 1930, with 100 lives; the *Georges Phillipar* in 1932, with 40 lives; the *L'Atlantique* in 1933, with 7 lives (while on her trial trip), are perhaps not so well known in this country, but all will remember the *Morro Castle,* which burned off the New Jersey Coast in 1934, with a loss of 110 persons. Realizing the shortcomings of this system of fire control, several maritime countries undertook independent studies to develop improved methods of construction to effectively control shipboard fires. The delegates at the 1948 conference brought with them the knowledge gained from the numerous tests which had been conducted, and experience in actual shipboard application of the principles involved.

Marine Fire Research in the U. S. A.

In this country, research on the subject of passenger ship fire protection has been led by Mr. George G. Sharp, well-known naval architect, who has long been active in NFPA marine affairs. He conducted a series of early tests in 1933, and after the *Morro Castle* fire he was made Chairman of the subcommittee on fireproofing and fire prevention of the Technical Committee appointed by the U. S. Senate to develop rules to ensure the safety of the United States merchant ships. Mr. Sharp's subcommittee made many tests on an actual ship, the *Nantasket,* and from the results developed a method of complete fire-resistant or incombustible construction.[1] This necessitated considerable research on the part of several agencies and private companies to develop materials which would meet the required standard of incombustibility, and also have the heat and sound conductivity properties, weight, workability, strength, and decorative qualities required for passenger ship work. The problem was further complicated by the necessity of having this new

1. See also "Fire-Resistive Ship Construction and the *Nantasket* Experiments" by Comdr. H. L. Vickery, U.S.N. (C.C.), NFPA Proceedings 1937, pp. 55-61.

type compare favorably with the cost of ordinary wood construction used up to that time in accommodation areas.

The principles underlying the recommendations prepared by this subcommittee were published in Senate Report No. 184 and, although never passed into law by the Congress, were nevertheless incorporated in the U. S. Coast Guard regulations for the construction of passenger vessels.[2] All large passenger ships built in this country since 1936 have embodied in their construction this new system of fire control.[3] Our rules have undergone numerous changes during the past thirteen years as a result of many lessons learned by designers, builders and operators, but the basic concept has remained unchanged, and it has proved well founded.

While we in the United States were thus involved in our experiments for developing new methods — and, as you know, many members of the National Fire Protection Association were actively engaged in this work — Great Britain, France, Italy and Sweden were also directing their efforts towards a similar goal. Since there was very little liaison between the various governments and private organizations throughout the world carrying on this work, it may readily be understood why the solution to the problem was approached from many divergent points of view. In one sense, this was perhaps fortunate, since more possibilities were probably explored than would have otherwise occurred under a single research group. It did, however, seriously complicate the problem of arriving at a simple, clear-cut formula, upon which all nations could agree at the conference, and which would fit into the pattern already laid down for industry within the several countries, which, like our own, were well advanced in improving the safety standards of their merchant marine.

The 1948 International Conference

The 1948 Conference was attended by representatives of thirty countries, and had been the object of active preparation for nearly five years. The subjects covered were substantially the same as those discussed at the previous conventions, except that this time the necessity of developing a more comprehensive fire code was thoroughly appreciated by all, and, therefore, commanded the attention of the delegates, commensurate with its recognized importance. The loss by fire in recent years of such vessels as the *Empress of Russia, Monarch of Bermuda* and *Normandie* no doubt had considerable influence in bringing this about. Another notable feature of this Conference was that, while the 1914 and 1929 Conventions were concerned almost entirely with regulations for passenger vessels, many of the rules, including those relating to fire extinguishing systems, have been extended to apply to cargo ships as well.

Early discussions at the Conference between members of the subcommittees considering methods of structural fire protection revealed that there was considerable difference of opinion between the several countries, each of which had definite proposals to offer. However, it became evident that all the proposals could be summarized in the three methods advocated by the United States, France and Great Britain. The method advanced

2. See also "The Application of Senate Report No. 184" by W. G. Esmond, NFPA Proceedings 1938, pp. 146-151.

3. See also "Safety Features in New Vessels Under the Construction Program of the Maritime Commission" by Comdr. H. L. Vickery, U.S.N. (C.C.), NFPA Proceedings 1939, pp. 36-40.

by these three countries was, in each case, based on a different assumption as to how an incipient fire could be controlled, but it seemed probable that each could be developed to accomplish the same purpose, so all three were presented for adoption in the final convention. This course of action was recognized as being essential, since — for various reasons — no one of the three methods could be agreed upon to the exclusion of the other two.

Many countries already had rules and regulations governing the construction of vessels under their respective flags, and the adoption of a single system would not only cause great confusion in the shipping industry of those countries whose proposals were not accepted, but might adversely affect the ratification of the Convention by these countries. It was accordingly decided to recognize the three methods as alternatives to one another, thereby enabling a country — not already committed to a definite policy — to adopt any one of the three methods which would be most suitable to its needs, and also in consideration of the availability of suitable materials and the equipment of its shipbuilders.

Basic Agreements for Fire Safety

All, however, agreed on certain fundamental principles. It was decided that passenger vessels should be divided longitudinally into *main fire zones,* and that the maximum length of such zones, as determined by the 1929 Convention, should be retained, i.e., 131 feet. It was realized, though, that the bulkheads forming these zones should, in association with the watertight bulkheads, extend from the keel to the uppermost deck, rather than be confined to the superstructure alone. Each deck in the vessel would also be constructed so as to form fire boundaries. Another feature, common to all three methods, was the protection of the main stairways by entirely surrounding them with Class "A" fire-resisting bulkheads, which are intended to provide a smoke- and flame-free means of escape for passengers and crew from the lowest deck on which they are quartered or working, up to the lifeboat embarkation deck. These enclosures also provided access for fire-fighting parties, and at the same time served to prevent the spread of fire from deck to deck, via draft inducing shaft. The stairway enclosures were, of course, fitted with self-closing fire doors at each deck level. It was further agreed that Class "A" bulkheads should separate spaces constituting the greatest potential fire hazards, such as machinery, service and cargo spaces, from accommodation areas. Similarly, control stations, i.e., spaces in which radio, main navigating or central fire-recording equipment, or the emergency generator is located, should also be bounded by Class "A" bulkheads.

The Class "A" bulkheads referred to must be constructed of steel or other equivalent material, and must provide one hour integrity when exposed to a standard fire test. It was agreed that the main structure, including decks, and deck houses, should be of steel, except that each Administration has the authority to sanction the use of other suitable material in special cases. It was also agreed that each fire zone should have its own self-contained ventilation system to prevent the spread of flame or smoke to adjacent zones.

The portion of the regulation on which it was necessary to reach a compromise by accepting three alternative methods concerns the method of construction within each *main fire zone.* These may be summarized as follows:

Method I: Advocated by U. S.

The use of fire-resisting materials for the construction of the ship, and for all internal bulkheading, paneling, ceilings, etc., throughout the passenger and crew accommodations. By this means, a fire in a cabin or similar space would be contained wholly within the space for a period during which the fire would either burn itself out or give time for fire-fighting parties to attack it while it was still of small proportions. In general, no detection or sprinkler systems are employed in the accommodation and service areas.

Method II: Great Britain

The fitting of an automatic sprinkler system, with sprinklers located throughout every part of the accommodation spaces containing combustible material, and provided with an indicator system which will register at the bridge or fire control station the occurrence of a fire. With this arrangement, a fire in any space immediately actuates the sprinklers within the space, which extinguish the fire, and automatically give an alarm, enabling the fire-fighting party to be directed to that area. This method, in general, places no restrictions on the type of material used in internal divisional bulkheads, and it can be assumed, therefore, that wood will be largely used for this purpose.

Method III: France

A system of subdividing each *main fire zone* into smaller zones, containing, for example, a small number of cabins, the boundary bulkheads of the zones being of fire-resisting or incombustible construction, but permitting a restricted use of combustible materials and furnishings within each of the smaller zones. An automatic fire detection system covering spaces in which fire might be expected to originate is provided, but, in general, without the installation of a sprinkler system. This method is intended to contain a fire within a very limited area, which, although larger than individual rooms in the American system, is bounded by bulkheads of greater fire-resisting qualities than required in the stateroom construction by our methods.

The key to the improvement in these new regulations over those of the 1929 Convention is that these requirements are developed "with a view to preventing the spread of incipient fires from the space of their origin," rather than trying to contain them in a whole zone.

With regard to extinguishing systems, the regulations proposed by the new Convention do not differ greatly from the provisions of the 1929 Conference for passenger vessels, but are far-reaching, in that cargo vessels over 1000 gross tons are now included in the requirements for smothering systems in the cargo holds, portable fire-fighting equipment, and means for controlling machinery space fires by a bilge extinguishing system, using foam, inert gas, steam, or water sprinkler. This latter provision is one of the rare instances where the Convention requirements exceed those of present Coast Guard regulations for American vessels. It should be pointed out, however, that while we, in the past, have not required machinery space bilge extinguishing systems, except in special cases, involving fire pump distribution, a great many American cargo vessels have had this feature incorporated in their design, so that enactment of the Convention should not affect too many vessels in this country.

The regulations, as framed by this last Conference, ensure that where oil fuel is used for engine or boilers in a passenger ship 300 feet in length or over, a fire in any one compartment will not put all the

fire pumps out of action. Also in a cargo ship, if the arrangements are such that a fire in any one compartment, for instance, in the machinery space, should put all the pumps out of action, there must be some other means of extinguishing the fire.

In the past, regulations covering electrical installations have been completely omitted. At this Conference, France, Italy, Canada and the United States presented proposals on this important subject, but there was considerable opposition to the inclusion of an electrical section by many of the other delegates. Eventually, however, it was agreed that setting up certain basic principles governing electrical installations was essential to safety. The regulations finally adopted are substantially those contained in the proposals presented by the United States, and provide that services essential for safety will be maintained under various emergency conditions, and that the safety of passengers, crew and ship from electrical hazards will be assured. These requirements will have practically no effect on current U. S. practice, but will prevent some foreign vessels from employing such undesirable and hazardous installations as were discovered on the ex-German liner *Europa,* when that vessel was taken over by this country toward the end of the last war. It was found that they used a one wire system, with grounded return through the hull. The wires were ordinary fabric covered, and were run in wood moldings. It is my understanding that considerable difficulties were experienced with electrical fires before this vessel was turned over to the French, who are now engaged in completely rebuilding it for their own use.

Conclusion

The provisions of the Convention are scheduled to come into effect on January 1, 1951, provided the necessary number of countries signify acceptance within one year prior to that date. If however, this should not be done, it will come into operation twelve months after the date on which the necessary number of Governments have acceded to it. This interval of one year, it will be appreciated, is a very necessary convenience, both to ship owners and ship builders. Six years elapsed after the 1929 Convention before the United States Senate ratified it, but it is gratifying to report that on April 20, 1949, action by the Senate placed the United States among the first to accede to the 1948 Convention. This is the more appropriate in view of the active part taken by this country in pressing for higher standards of safety on ships throughout the world.

In so far as the American Merchant Marine is concerned, the principal effect of this Conference will be to place it in a more favorable competitive position in relation to vessels of many foreign nations as regards construction costs. Actually, the proposals agreed upon in London last spring will have very little influence on current shipbuilding practice in this country, since our present Coast Guard regulations are perhaps the most stringent in the world, and, in many instances, served as a pattern for the international agreements reached. The Convention will, however, greatly improve the over-all standard of marine safety throughout the world. Of necessity, the regulations are written in such a manner as to give considerable latitude to each Administration in preparing its own detail requirements, but as long as the basic principles laid down by the Conference are adhered to, we are bound in the years ahead to see a large decrease in loss of lives and property at sea as a result of shipboard fires.

Fighting Fires in Windowless Buildings

By Anthony J. Mullaney,
Chief, Chicago Fire Department

One of the most important lessons of fire fighting learned through the years of hard, bitter experience is that the art or science of proper, adequate ventilation, quickly done, is the basis of efficient and successful fire fighting. This lesson has been expounded many times over in stubborn basement fires where natural ventilation was not possible. It has been taught numberless times in those many warehouse and loft-type buildings having a few windows and heavy laminated floors supported by solid masonry walls, which were impossible to cut open or breach while fire consumed the contents. Fires in subways, tunnels and mines have revealed the same grim truth, time after time. Cargo-hold fires in ships have presented the same problem repeatedly. Even in more lightly constructed structures firemen of bygone days were mistakenly reluctant to break window glass or make badly needed openings in roofs and floors to relieve the accumulated pressures of combustion gases which were both a direct cause of fire spread within the building and a serious threat to the lives of any fire fighters who ventured into the fire area to perform fire duty.

A fire station next door is no assurance of safety if the firemen are delayed in gaining access to the building in case of fire. Combustible interior construction, no sprinklers.

Ventilation

It is an accepted axiom of the fire service that two-thirds or more of the art of successful fire fighting is based upon proper ventilation of the burning building. Prompt and proper ventilation accomplishes several purposes at once. These are:

1. The building is relieved of accumulated heat, smoke and gases, thereby making entry possible for rescue and fire-fighting purposes.

2. The heat, smoke and gases are quickly drawn upward and outward through a selected narrow channel such as a stairwell, elevator shaft or similar pathway, thus preventing the further spread of fire within the building.

3. Explosions of combustible smoke and gases are thereby prevented, eliminating the dread danger of "back-draughts," a notorious killer of fire fighters.

Time after time, successful ventilation practices have shown that the cost of re-

NOTE: This article is based upon a paper presented by Chief Mullaney at the 53rd Annual Meeting of the National Fire Protection Association, San Francisco, May 16-19, 1949.

A modern department store. Fire-resistive construction, protected throughout by a supervised sprinkler system. Open stairway and escalators extending to fourth floor.

placing window glass or repairing a vent hole in a roof is far less than the value of the contents of a structure saved by such ventilating action.

Fire protection specialists, quick to grasp the importance of this lesson, years ago recommended heat-actuated vents over theatre stages and stairwells. Large thin glass windows or explosion panels were specified in buildings housing fast-burning or explosive contents or processes. Heat-actuated devices are installed to open windows and start exhaust devices and at the same time operate automatic extinguishing systems in case of fire. In recent years fire department public relations activities, backed up by a consistent record of successful fire-fighting operations, have led the public in a good many communities to recognize that the thumping of an axe within a building is a necessary part of controlling the fire and not a case of uncontrolled firemanic or fire-maniac destruction.

New Trend in Building Construction

Now, at a time when we should be in a position to reap the benefits of these many bitter lessons and the slow cooperation of the public, we are faced with a new trend in building construction. Many new buildings have completely blank walls with no window openings and have no provision for necessary roof ventilation. Older structures are being remodeled or "modernized" in the same manner. There may be practical and justifiable reasons for this type of construction. Certain processes require controlled conditions of temperature and humidity, which are more easily accomplished in a tightly built structure free of heat and cold absorbing glass window panes. Eye appeal and comfort are certainly features in the selection of this type of building construction.

Hazards of Windowless Buildings

Buildings of this type require either an adequate mechanical ventilating system or in most cases a complete air conditioning system. This introduces the hazard of smoke, heat and fire being conducted from one building area to another, unless proper dampers are operated by automatic thermal or electric eye smoke detection devices.

The absence of daylight inside the

A multiple occupancy office and manufacturing building, built in 1948. Area 51,300 sq. ft. Fire-resistive construction, vertical openings protected, supervised sprinkler system.

building requires high illumination levels. This in turn means heavier electric current loads, larger capacity fuses and associated equipment. In case of fire it is probable that the electric current may be affected or interrupted entirely, plunging the involved area into total darkness on the brightest day.

Smoke and Fire Gases

The smoke and gases which accumulate cannot be drawn off through window openings because there are none, and since stairwells and other vertical shafts will probably have protective enclosures, firemen will have to enter an area heavily charged with smoke and the gases of incomplete combustion. Probably already under the pressures which build up under such conditions, the stage is set for either a pressure explosion or more likely a back draught type of explosion which takes place when oxygen is permitted to enter a confined fire area. Building codes provide for the safety of the occupants by requiring protected stairways for normal use, but little thought is given to emergency conditions within tightly enclosed structures.

The interior of a windowless building might become seriously involved by fire before it becomes apparent from the outside. What about the problem of the firemen going into such a building through the usual stairwells and other entrances under such emergency conditions at the same time the occupants are forming a counter stream of traffic in their haste to leave the danger area?

The installation of outside fire escapes is contested because they detract from the appearance of a structure. However, outside fire escapes and smoke-proof towers have a definite place in the field of fire protection and more particularly in the type of structure under discussion.

"Face-lifting" of Old Buildings

Old buildings which have been modernized by closing window openings present the same problems, often in more serious form because of combustible interiors and structural defects hidden behind modern appearing fronts. What are some of the questions that a forward-looking and prepared fire department must ask to find the proper answer? What is behind the exterior wall? Is the wall solid or just a veneer? How is the veneer attached to the building? Is the material combustible? What are its characteristics when subjected to heat? Is it a masonry veneer which may crack and crumble if a fire stream is played against the outside while the inner surface is heated? Is it a metal veneer? How is it attached? Will it conduct heat into a building if exposed to an outside fire? Will it fail under the heat of fire conditions? Just because the material is noncombustible is no assurance that it will not be hazardous unless it is used properly under the right conditions.

Glass blocks are being used extensively to close former window openings. Experi-

ence has shown that such a panel yields readily to usual forcible entry methods except when a metallic window or door frame is set into the center of the glass block panel. This offers considerably more resistance than the usual access panel.

Fire Department Access Panels

Many windowless buildings having masonry, brick, tile or metal sheathing have no access panels for rescue or emergency fire fighting conditions. Few building codes are modern enough to have kept abreast with this type of tightly built structure. It seems only reasonable that amendments should be made to all such building codes to enable any fire department to have at least some chance of performing the function of protecting lives and property from fires. Fire protection authorities are in agreement that provision should be made for such access panels and one large city already has written the following into its code:

"Above the first story or ground floor of a building, fire department access panels shall be provided in every frontage, spaced not more than fifty feet apart on centers horizontally. Each panel shall consist of either a fixed sash with a single sheet of flat glass at least thirty-two inches wide and forty-eight inches high and openable from either exterior or interior. Wherever practical, one such panel in each story shall give access to a stairway or, where there is no stairway at the front exterior wall, one such panel in each story shall provide access as close as practicable to a stairway."

While height limitations are not specified in this ordinance, it is reasonable that such panels should be required in buildings more than two stories in height or having more than two thousand square feet in area on any floor above the ground floor, at all levels within reach of fire department ladders either from the ground or from existing adjoining structures. The size of the panels as specified in this ordinance is a minimum and to facilitate rescue and other fire department operations the dimensions should be increased by at least one foot in height and one foot in width, with a sill height not more than three feet above the floor.

Such panels should be hinged to permit full use of the opening and must have glass or equally transparent material, or wired glass where necessary.

Automatic Fire Protection

In windowless buildings adequate automatic fire protection facilities should be required, such as automatic sprinkler systems, automatic fire detection devices and, in those special cases where limited special hazards may be permitted, auxiliary protective devices, such as exhaust fans, automatic electric current and gas shutoffs so that fires may be detected and extinguished in their incipiency with a minimum risk to life or property within or adjacent to the structure.

The problem of fire protection in buildings of this type is complex and requires careful study of existing conditions and also of the trends of use and occupancy in order that adequate regulations can be promulgated in the interest of fire and life safety. Because of the very limited fire and accident experience in buildings of this type, provision should be made for the exercise of reasonable discretionary power by building department and fire department officials in the interpretation and application of such code requirements on new construction and reconstruction or remodeling of older buildings.

Limitation of Combustible Materials

Since the seriousness of fire in windowless types of buildings is apparently far greater than in more easily ventilated

buildings of conventional construction, it follows that reasonable limitations should be made of combustible materials within the premises. This should include not only the furnishings and decorations but should also apply to the contents of a commercial building. Noncombustible materials should be used in the construction of partition walls, ceilings, false ceilings, flooring, interior trim and other interior parts of the structure. Decorations should be limited in quantity and should be noncombustible or treated for flame resistance. It seems reasonable to regulate the display and storage arrangements of merchandise, including construction of shelving, counters and similar fixtures. Not only should there be clear aisles and passageways, but ready access must be available to storage spaces behind false walls and partitions. Where such spaces are extensive, automatic fire detection or extinguishing equipment should be required.

Cellar Pipe Openings

Properly protected openings should be made in all concrete floors at reasonable intervals for the efficient use of basement nozzles. Most concrete slab construction is reinforced with steel rods, closely spaced, and is a serious hindrance when such floors must be breached for fire-fighting purposes. Newer panel or radiant types of heating involve the use of hot water or steam pipes in floor and ceiling slabs. Cutting into one of these pipes may involve a shower of scalding water or a

A four-story building occupied by a greeting card manufacturer. Window openings closed with glass blocks. The heavy timber interior construction and combustible contents are protected by automatic sprinklers. There are two interior stairways and an elevator shaft, all enclosed; two exterior fire escapes reached by 3-ft. by 7-ft. doors. Air conditioned throughout. Heavy plank roof, 2-in. cork insulation; no skylights.

hot steam bath, which not only is dangerous but may further contribute to low visibility in the area.

Insulation and Acoustical Materials

Insulation and acoustical materials applied to the interior of these buildings should be of a type reasonably fire-resistant or which add a minimum to combustible contents. Interior finishes and trim should be of the same or similar material. Some of the newer interior finishes are made of pressed fibrous substances and a variety of other highly combustible materials which are hazardous.

Attention should be given to the smoke producing qualities of these materials and whether the products of combustion are harmful or dangerous to human life. This is far more important in buildings wholly dependent upon mechanical ventilation equipment for air changes, as such equipment will probably be inoperative because of emergency conditions caused by the fire. In such cases combustion will be incomplete and the toxicity and explosibility of the combustion products will undoubtedly be increased considerably.

Enameled Steel Walls

One type of construction so new that there is practically no fire experience available is the type having enameled steel exterior walls or siding of this material. Most buildings of this type are prefabricated structures, but this same kind of material is being used to modernize the exteriors of older mercantile buildings. The fire-fighting problem involved here is that of gaining access to the spaces behind the metal sheathing and between the wall studs. There is no information as to how long these enclosures will withstand the high temperatures to which they may be subjected in fires.

Unless these spaces have been properly fire-stopped during reconstruction, fire can easily spread upward and probably into the various floors of the building. It will be very important to determine carefully the actual spread or travel of fire in these concealed spaces in order that extinguishment may be complete.

Vertical Openings

Stairways, vertical shafts, chutes and ducts of all kinds are nearly always a fire-fighting problem in any building unless such vertical passageways are properly protected. Draughts are permitted by unprotected floor openings, which greatly aid the upward spread of smoke and hot gases. This allows the fire to travel upward very quickly and often to spread out horizontally on the upper floors of such buildings. Windowless buildings have more vertical ducts and passageways because of the much larger ventilating and air conditioning requirements as compared to conventional structures. Careful attention should be given to the design and installation of such ducts and shafts so that none of the construction materials, including any acoustical treatment, will contribute to a fire or aid in its spread.

Typical installation of these systems usually provides separate ducts for each floor, or in the case of very large buildings, there are several ducts for various sections of each floor. All such ducts are usually assembled into one or more vertical shafts which terminate in the ventilating or air conditioning machinery space either at the top floor or basement. Smoke or hot air drawn into one duct will eventually be recirculated, at least in part, to the other portions of the building. This can result in extensive smoke losses unless there is smoke detection equipment properly installed, and air conditioning systems can also spread hot gases, sparks or embers

Retail clothing store built 1948-49. Fire-resistive construction, but wood counters and fixtures. No automatic sprinklers except in machinery space. Window area less than 5 per cent of exterior walls. No skylights or roof ventilators.

from one building section to another unless automatic control devices are provided. Since automatic control in case of fire nearly always includes a complete shut-down of all ventilating or air-conditioning equipment, no fresh air will be brought into the structure during a fire. Continuing combustion will soon use up the available supply of oxygen.

This will present two major fire-fighting problems. First there will be an accumulation of products of incomplete combustion, including carbon monoxide, unstable sulphur and nitrogen compounds, smoke tars and other materials. These products are heated by the fire to temperatures higher than their ignition temperatures, but do not burn because of the lack of oxygen. As soon as fresh air is admitted, combustion is completed in the form of a typical back-draught explosion with all of its attendant hazards to the occupants, firemen and to the building.

The second problem, aside from the explosion danger, is that practically all such gases are toxic or suffocating in their effect upon the human system. This will require the use of self-contained oxygen breathing equipment by all persons operating in the fire area. Most fire departments have some self-contained oxygen or fresh-air breathing devices, but not in sufficient quantity to equip the number of firemen responding on a box alarm assignment,

much less the number responding on a multiple alarm, which undoubtedly would be required to handle a fire under the conditions described.

Smoke Removal

Access panels, previously discussed, can be used as vents to relieve the fire area of the unburned gases, which will probably ignite explosively at or near the vent openings. Since all ventilating machinery is stopped during the fire it will be necessary for an efficient fire department to have portable venting apparatus, such as smoke ejectors, exhaust blowers, compressed air jet type air movers, or similar equipment having sufficient capacity to handle a large volume of air in a relatively short time. Such devices should be set up in openings on the leeward side of the building and placed in operation as soon as water lines are available for advancement into the fire area. Similar access openings on the windward side of the structure should then be opened to speed the clearance of smoke and hot gases as, and when, fire-fighting operations will permit such action. This is essentially horizontal ventilation as currently practiced plus mechanical movement of smoke and air for faster operation.

All operations previously described could be carried out only at building heights within reach of fire department ladders. It is imperative that the design and construction of taller buildings include all necessary arrangements, equipments, and devices which will insure the greatest safety to the occupants against fire as well as all other emergency conditions.

An important factor which may be overlooked in a building wholly dependent on a mechanical ventilating or air conditioning system is the possible result of a failure of the system due to power failure or accidental shutting down without evacuating the building.

A brief survey of windowless structures in Chicago revealed several varieties which could be regarded as distinct types. The photographs reproduced in this article show typical windowless buildings in Chicago.

Fire Safety in Design

Fire safety can be achieved in these new tightly constructed buildings through proper design, but this objective can be fully attained only through the cooperation of architects and designing engineers. The NFPA and its individual members should actively seek the cooperation of architects and engineers, through architectural and engineering schools, professional technical societies and through all the available channels, rather than waiting for disastrous fires which may lead to drastic and expensive legislation. Tests should be conducted to provide information on unknown factors. This new problem of fire safety can and should be solved through the cooperation of all concerned.

Spontaneous Ignition of Pyroxylin Triangles

By Forrest J. Sanborn,
Office of the Chief of Engineers, U. S. Department of the Army

Spontaneous heating is usually the result of combining an oxidizing chemical with a combustible substance aided by a moderate temperature. Unlike the more common heating process of an oxidizing oil finely dispersed on cotton, pyroxylin plastic is a solid which requires no other combustible material to assist it to ignition.

About three years ago a fire in pyroxylin triangles served to redirect our attention to the hazards of the common household and office variety of pyroxylin plastic. The phenomenon does not occur frequently enough for most fire protection engineers to readily recognize the symptoms. After all the possible causes were run down, the simple fact remained that the fire had originated in some unused pyroxylin triangles which had been stored in their original paper wrappers and wood boxes. These triangles had been newly purchased and had been placed in dead storage in a one-story unventilated noncombustible warehouse. Inspections of the building were made weekly, but there were no heat or electric lights, or any foreign material which could cause a source of ignition. During the month of June, several hot days occurred in succession and it is not unlikely that the temperature in the warehouse reached 120°F. during the peak of the day. A skylight permitted direct sun rays to shine on a few of the boxes. During the night, fire broke out in the storage warehouse. It was discovered promptly and isolated to a few cases of triangles.

Similar triangles taken from undamaged boxes were examined and tested for evidence of spontaneous heating. Many were found to have the paper wrapping decomposed to the brittle point as if exposed to an acid vapor. Some of the triangles were crazed and warped as though exposed to intense heat. When tested for evidence of spontaneous heating they appeared fairly stable. Ignition of a single triangle required a temperature of 250°F. However, a slight temperature rise was perceptible at 140°F., which increased ever so slowly up to about 200°F. No large scale tests were made, but it is believed that if large samples had been used, a lower initial heating temperature would have been obtained. When one of the triangles, still wrapped in its paper envelope, was exposed to the direct sun, it charred in 40 minutes as shown in the photograph.

Two fires of similar origin occurred in a military installation in Texas. The first fire broke out in new pyroxylin triangles

individually wrapped in paper envelopes and cardboard cartons, which were stored in a one-story noncombustible warehouse which had no ventilation. It had been hot for ten days prior to the fire and a glass skylight permitted direct sun rays to shine on the wood cases. Fire broke out at midnight and was confined to stock in the immediate vicinity. About a month later at the same location, a few cases of new triangles had been allowed to stand outdoors in the sun all day and then placed in a warehouse for the evening. At midnight, fire broke out in the cases where they still rested on a small hand truck. The fire did not spread to other materials and its origin was definitely traced to one of the cases.

At an Army installation in Hawaii, pyroxylin triangles and firing range tables ignited from spontaneous heating after a prolonged period of hot days. This material was located in a locked warehouse where it had been stored for two years. No one had been in the building for a week. There was no wiring or other possible source of ignition near by. Windows in the sides of the building permitted direct sunlight to shine on the wood packages. Fire broke out at the end of the day, giving off volumes of nitrous fumes.

In each of the incidents the following conditions were present:

a. New pyroxylin plastic, packed in original paper wrappings.
b. Wood boxes, which insulated the material and retained the initial heat of decomposition.
c. Several days of hot weather prior to the fire.
d. Direct sunlight through windows or skylights on to the packaged material.
e. Room temperatures of 100 to 125°F.

Since the investigation of these fires, several people have called attention to pyroxylin plastic drafting instruments that have crazed, warped and delaminated. In each case, these instruments had either been confined in a warm location or tightly packed in container. In one incident, drawing instruments that had been used for several years were packed away in the attic when the owner went to war. On his return four years later, all the drafting angles and French curves had crazed. Furthermore, the owner reports that the nickel coated steel instruments were badly corroded.

The corroded instruments and badly deteriorated paper wrappings are explained as the result of nitrous vapors given off during the decomposition period. Acid on the surface of pyroxylin is readily detected after prolonged storage at elevated room temperature. Mr. Allen Cobb of the Eastman Kodak Co. has explained in a recent article that traces of nitrous oxide have been detected coming from the surface of pyroxylin at a temperature as low as 120°F. This gas, in contact with easily decomposed paper wrappings, lowers the ignition temperature of paper, thus making it more subject to ignition by the self-generated temperature of the pyroxylin.

Interesting as the scientific facts of this exothermic reaction and the possibilities of self-ignition at unusually low temperatures are, it is more important to recognize the potential hazard and precautions required. The simplest precaution is to keep packaged pyroxylin in locations well below 120°F. and provide means of dissipating any self-generated heat. Separate cartons to provide ventilation space around the carton. Keep pyroxylin away from steam pipes, skylights, or other sources of heat, and of course keep under automatic sprinkler protection if any sizable amount is stored.

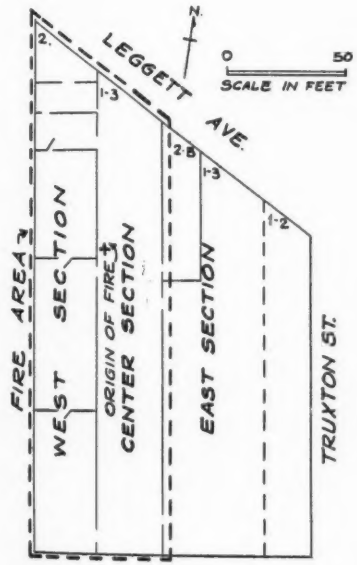
Electrolux Corporation Fire, New York

By Wm. G. Hayne, New York Board of Fire Underwriters

The precept that fire protection begins at the architect's drawing board, and not at the alarm box is amply proved by the fire on March 10, 1949 at the warehouse of the Electrolux Corporation, New York City. The extensive damage inflicted on this structure and the speed with which the contents was involved were to be expected, since such weaknesses in fire protection as unprotected structural steel members, large areas without automatic sprinklers and large quantities of combustible merchandise piled comparatively high, were entirely disregarded.

Construction

This building consisted of three sections erected at different times (see diagram). The west building or section erected in 1927 was a one equal to two and small part two-story fire-resistive building of 18,700 sq. ft. total area. Walls with poor or no protection at openings separated the structure into six areas.



During the war another building was erected 50 feet to the east. The large one-story structure was of noncombustible but not fire-resistive construction. Walls were brick with large wired glass window areas. Roof was reinforced concrete on unprotected steel beams, girders and columns. The building was one unbroken area totaling 28,700 sq. ft.

More recently the 50-ft. wide open area between the east and west buildings was enclosed and made into a center section. Steel girders were supported on steel columns which in turn supported steel beams, and a roof consisting of composition on two-inch pre-formed metal edged tongue and grooved gypsum planks. All steel work was unprotected and side walls (former exterior walls of east and west sections) contained numerous wired glass windows and several unprotected or poorly protected openings. The area of this section was 16,500 sq. ft.

Protection

Private protection for the three sections consisted of numerous first aid appliances, a four-inch standpipe system and hourly supervised watchman tours. The only sprinkler protection afforded was by a minor system installed under a balcony in the east section.

The entire premises was used for storage. Typical of the congestion was that in the center section where the fire originated. Here, vacuum cleaner hose, garment bags, paper cartons and miscellaneous acces-

Pitcher

Ruins of the 16,500 sq. ft. center section of the Electrolux Corp. warehouse, New York City. Large quantities of combustible stock, unprotected steel structural members and lack of fire divisions and sprinklers were factors in the destruction of the building on March 10.

sories were stored in contiguous high piles along both side walls of the long narrow area with the only access for fire fighting being from either end through the long narrow center aisle.

The Fire

At about 1:30 P.M. employees loading a truck from the center section smelled smoke and upon investigation saw fire in a pile of baled vacuum cleaner hose near the center of the section. The hose, packed 50 to a bundle and wrapped in paper and then in burlap, was laid six bundles in a row with each additional row crosswise to the row below. The bundles were piled 25 high (20 feet) and were two deep to the center aisle.

The fire appears to have originated on the fuzz of the burlap wrapping about five feet above the floor. It spread quickly to the top and jumped from one pile of merchandise to another. One employee promptly operated a private fire alarm box as others attacked the blaze with extinguishers. Although the fire department arrived without delay, the fire had already reached multiple alarm proportions, and second, third and fourth alarms were struck by 2:20 P.M. Sparse distribution of hydrants necessitated long stretches of hose, but ultimately 20 hand lines and six deck pipe lines were brought into play.

The fire soon spread through unprotected openings to all parts of the west section and along the west wall of the east section. That the fire did not enter the east section to any great extent was due to the fact that the fire department was able to enter the section and operate lines along the exposed wall. The absence of large quantities of combustible storage along this wall, as well as a favorable wind were also important factors.

Damage

Damage to the center section was excessive. The heat of the fire softened the un-

protected steel structural members, causing them to buckle and drop the roof into the building. There was practically no salvage value to the contents in this area. The fire-resistive west section withstood the fire reasonably well, although exposed to considerable fire. There was no collapse of any portion of this section, but the interior was blackened, windows were broken and the composition roof covering burned away or was badly damaged. Storage was heavily damaged, but salvage will be considerably more than in the center section. Records in this section stored in files constructed of light metal frame with cardboard sides were severely damaged. The records in single walled metal cabinets, although charred considerably, fared very much better. The greater portion of the contents of the east section was undamaged. Loss is estimated to be in excess of $2,000,000, the largest single loss payment ever made by insurance companies in New York City.

Oakland Pier Fire

Destruction of Pier 4 at the Army Base, Oakland, California, on March 15 is further proof that fire protection should begin at the architect's drawing board. This high 1-story combustible building, comprising an undivided fire area of 151,200 square feet, should not have been built without adequate fire walls and a sprinkler system.

Pier 4 consisted of an asphalt coated concrete deck laid on filled land. A 30-foot apron supported by concrete and wood piling extended over the water. The one equals two-story wooden pier shed comprised a single fire area 1008 feet long by 150 feet wide and at the time of the

Based upon reports submitted by City of Oakland Board of Port Commissioners, and Pacific Fire Rating Bureau.

Oakland Fire Prevention Bureau

"Inaccessible for fire fighting," often cited as an important reason for disastrous pier fires, was not a factor here. This pier burned to the ground because of another weakness in piers — large undivided area without sprinkler protection and crammed with combustible storage.

International

Pier 4 at the Army Base, Oakland, California, was the scene of a $1,000,000 fire on March 15. Such results can be foretold where combustible buildings comprising a large single fire area (in this instance 151,200 sq. ft.) are loaded with combustible contents. There were no sprinklers, fire walls or draft curtains in the 1,008-foot-long shed.

fire was heavily stocked with clothing, food, machinery parts, drums of oil, solvent, and paint awaiting shipment overseas. Overflow was stockpiled outside. Two ships, the *Sgt. George D. Keathley* and the *Young America,* were moored to the pier apron.

A few minutes before midnight the seven gangs of longshoremen loading these vessels left the pier for lunch. At 12:02 A.M., a walking guard touched his cigarette lighter to burlap wrapping on a stack of outbound cargo. (In his confession the guard was unable to provide a motive for his action.) He immediately telephoned the alarm, but flames had spread so rapidly that more than one-third of the structure was involved on arrival of the Post Fire Department. It was apparent that the shed and its contents were doomed and help was immediately summoned from Oakland and San Francisco because of imminent danger to other Army Base property.

Steps were started at once to remove the ships from the blazing pier. Crewmen of the *Keathley* were kept busy extinguishing fires in lifeboats and wetting down scorched decks and the bridge until two Army fire boats pulled her away. The *Young America* was able to back off under her own steam at 12:13 A.M., but not before deck paint had blistered and two Jacob's ladders were destroyed.

Exploding oil drums and dense black smoke hampered firemen as 21 pumpers and seven fire boats cooperated in a desperate and successful effort to save exposed pier sheds (nearest 69 feet away). The fire was brought under control at 6:00 A.M., but was not completely extinguished until March 18, when bulldozers pulled down the remaining walls and the cargo was pulled apart. Unofficial estimates place the loss at more than $1,000,000.

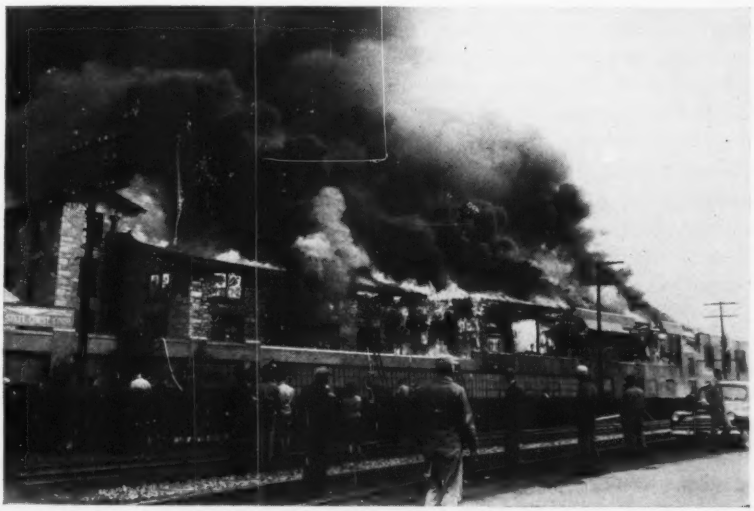
Dip Tank Fire, LeRoy, N. Y.

Heavy responsibility must be assumed by those who permit deviation from important details of recognized fire protection standards.

NFPA Dip Tank Standards recommend, in part, that drain boards drain to a closed drain tank and not back to the dip tank (par. 125), and that overflow drains should preferably terminate in outside buried tanks (par. 197). Disregard of these two provisions at the Union Steel Chest Corp., LeRoy, N. Y., is the principal reason for destruction of this plant, March 29. Other factors contributing to the loss were inadequate single source of water for sprinklers, premature shut off of sprinklers (understandable in this instance), weak public water supply, and failure of the fire department to pump into the sprinkler system. The price paid for these errors of omission and commission is estimated at $1,000,000.

Metal tool chests and fishing tackle boxes were the principal products manufactured in this two and three-story stone and masonry walled, wood-joisted building, 400 ft. by 50 ft. in area. A single source dry pipe sprinkler system (installed prior to 1900 and still equipped with many of the original parts including pipes of substandard sizes) protected the large undivided areas in the three-story structure. Sprinklers and hydrants were supplied through an 1800-ft. long, old 6-inch main off an 8-inch loop.

On the first floor a conveyor chain system carried the metal boxes through a 12-foot long; 300-gallon dip tank containing naphtha-thinned enamel paint. The tank was in a sprinklered area, was ventilated



Poor dip tank design and inadequate water for sprinklers were important factors in the destruction of this LeRoy, N. Y., metalworking plant.

and hooded and was equipped with an automatic water spray system beneath the hood. In contrast to this thorough protection for the dip tank other fire protection features in its design were notably weak. Drain boards extended beyond the hood and drained back into the tank; and a 4-inch overflow pipe ran out under the floor of the building, terminating flush with the outside wall.

At 9:00 A.M. a flash fire (cause unknown) occurred at the dip tank and drain board area. The water spray system and six sprinklers near the tank operated promptly and this automatic protection, plus prompt action of employees using foam type extinguishers, had the fire out in a few minutes without appreciable fire damage. In this relatively short time, however, considerable water flowed down the oversized drain boards and collected in the tank, forcing the flammable paint mixture out through the 4-inch overflow and onto the ground just outside the building. At least half the contents of the tank was discharged through this overflow, and open drums of paint near the tank had overflowed on the floor before employees could shut off the water spray and sprinkler systems.

No inspection was made of the building before shutting off the automatic protection, nor had the fire department been notified of the fire. It was not until the sprinkler valves had been closed that employees discovered that the paint on the ground outdoors had caught fire (ignition possibilities include a flash through the overflow pipe which had no trap or other flame arrestor). Flames were leaping against the wall and windows and had reached the wood boxed roof cornice 27 feet above the ground before the belatedly summoned volunteer fire department could reach the scene.

This picture illustrates graphically why overflow pipes from dip tanks should terminate in outside buried tanks. The burning liquid is naphtha-thinned paint discharged on the ground from a dip tank overflow.

Since radiated heat through windows fused many sprinklers on the third floor before the valves could be reopened, waterflow to sprinklers placed a heavy drain on the 6-inch main. Apparently, however, sprinklers were successfully protecting the third floor until firemen, after considerable delay, connected hose to the nearest hydrant, not using their pumper. As should have been foreseen, the resulting hose stream was very weak and the water supply to the sprinklers (single source system) was drastically cut. The hose was then moved to a more distant hydrant and this time, with the aid of their pumper, firemen were able to procure a good stream capable of reaching the fire on the roof. However, the damage had been done, as flames overpowered the third floor sprinklers which now lacked adequate water. Eight pumpers from neighboring towns that were eventually used on the fire (drafting most of their water from a nearby creek) had the fire under control by 2:00 P.M. By that time,

however, the roof had been destroyed and fire had burned down through most of the structure.

This fire is an example of the disastrous results that must be expected when fire departments do not have knowledge of the demands that must be placed on available water supplies at industrial plants under their jurisdiction. In this instance, it should have been obvious that with the heavy requirements of sprinklers on the public supply very little pressure remained for a hydrant-connected hose line and that the first step for the fire department should have been to pump from the hydrant into the sprinkler connection. It is reasonable to assume that damage would have been considerably less had the first-in company followed this procedure. Ample water should then have been procured to supply one line to the sprinkler connection (not used during the fire), and at the same time provide a hose stream adequate to reach the fire burning on the roof and out of range of sprinklers.

By no means all blame for depletion of water for sprinklers belongs to the fire department. In a building of combustible construction, with large undivided areas in which flammable liquids are handled the operation of many sprinklers was not improbable. Criticism must therefore be shared by those who sanctioned sole reliance for sprinkler water on a long 6-inch fire main the primary function of which is to supply fire department hose streams.

Die Casting Plant Fire

Fire on March 31 at St. Joseph, Michigan, has two points of interest for NFPA members. First, it emphasizes the hazard inherent in flammable hydraulic fluids and thereby lends weight to the recommendation that one of the less hazardous liquids developed for transmission of pressure be used. Second, this fire is another example of a "hundred dollar fire" that became a loss measured in hundreds of thousands because sprinkler equipment had not been maintained in operating condition.

The Paramount Die Casting Co. occupied a roughly rectangular 1-story brick, wood-joisted building 200 ft. by 100 ft. with a large wooden monitor. No fire walls or draft curtains subdivided this single fire area; sprinkler equipment installed several years ago had been out of service for some time and would have required extensive renovation to again become serviceable. The building housed eleven hydraulically operated die casting machines, gas-fired melting pots, grinders and other equipment used in the manufacture of aluminum alloy die castings. Oil lines carried oil (flash point 375-410°F.) to die casting machines under 800 lbs. pressure.

At 8:10 A.M., shortly after the day's operations started, one of the high pressure oil lines ruptured near the center of the building and sprayed oil over a hot die casting machine and a gas-fired aluminum melting furnace. Fire broke out at once on the machine and furnace, and although the oil pumps were immediately shut off, fire had already jumped to the wood-decked and wood-joisted roof. There was no delay in calling the fire department and

Based upon reports submitted by the St. Joseph Fire Department and the Michigan Inspection Bureau.

St. Joseph Herald-Press

Sprinklers that formerly protected this building had not been kept in service during recent years. On March 31, a pipe line ruptured and sprayed hydraulic fluid on a hot die casting machine. The ensuing fire jumped to the wood roof and spread to all parts of the building before hose streams could be brought into action.

response was prompt, but fire had spread through the combustible roof construction so rapidly that it was beyond control when apparatus arrived. Had sprinklers been in operation this fire undoubtedly could have been confined to the area of origin; or draft curtains, had they been installed, in the opinion of Fire Chief W. H. Mitchell, would have localized the heat long enough to allow his men to get into the building with hose lines. As it was, entry was impossible and St. Joseph's three pumpers aided by one from Benton Harbor concentrated on keeping fire from an adjoining fruit processing plant. That they were successful can be in part attributed to a 12-inch fire wall with an 18-inch parapet separating the two buildings.

The fire was of short duration, burning itself out in less than an hour, but in that time the roof had fallen in and most of the equipment was damaged or ruined. As soon as debris cooled, several valuable dies were recovered, cleaned and oiled. Because of this prompt action they can be used again. Preliminary estimates place the loss to the building at $40,000 and to the contents $300,000. Total $340,000.

Hollywood Park Race Track Fire

To a casual observer the massive steel roof supports, concrete flooring and stucco exterior walls may have created the impression that there was nothing to burn at the combination grandstand and club house of the Hollywood Turf Club, Inglewood, California. But beneath this superficial appearance of noncombustibility were certain other structural features — numerous concealed spaces under floors, behind walls and above ceilings, combustible wall studs and roof decking, and a large undivided area of open construction, which, be they in a grandstand, pier, warehouse or any other structure, usually spell destruction if fire has a chance to take hold. On the night of May 5-6 these structural weaknesses in conjunction with delayed discovery allowed fire to cause damage to the combination grandstand and club house that may exceed $3,000,000.

Fire when first discovered was in the vicinity of these elevator shafts in the club house. At lower right ruins of the exterior wall covering of stucco on chicken wire are visible.

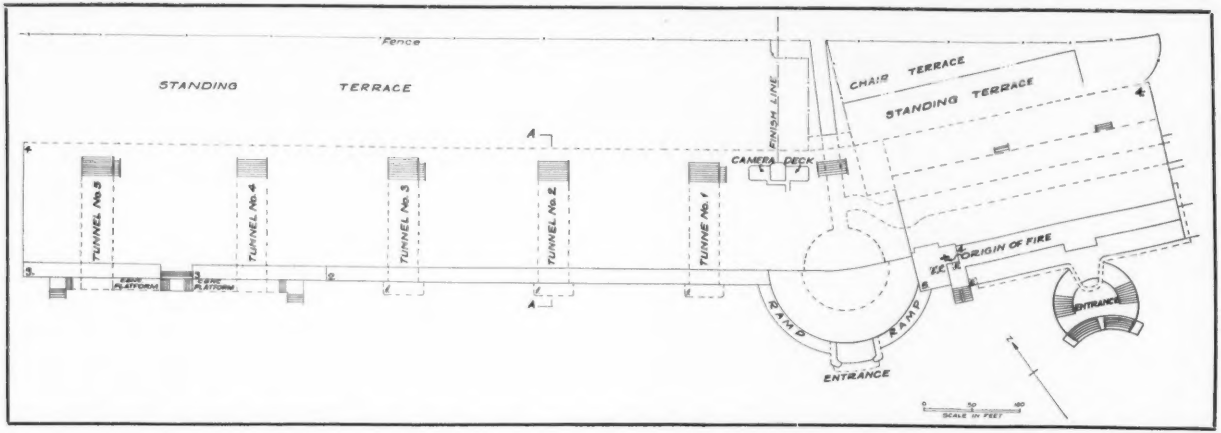
Construction

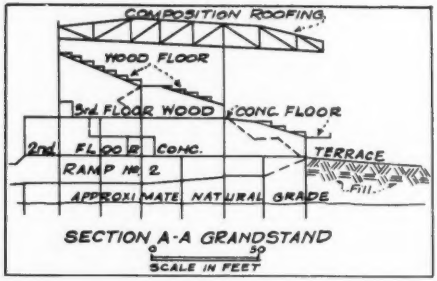
Reference to the accompanying diagram will help to visualize the Hollywood Park grandstand. The 1250-foot long structure occupied an area of approximately 175,000 square feet and varied in height from four stories in the rear to one story on the track side (necessitated by the slope of the grandstand seats). The three floor levels above the first floor level of the easterly 275 feet of grandstand were occupied as a club house. Kitchen, dining room, lounge, offices and elevators were located in this area. The various levels beneath the rest of the grandstand contained sellers' and cashiers' rooms, concessions, maintenance rooms and large areas yet undeveloped. Principal construction features included unprotected steel frame trusses, beams and columns with exterior walls mainly stucco on chicken wire over 2 x 4 studding. Metal lath and plaster was used in the club house in the construction of false ceilings hung from wood joists. The structure was honeycombed with nonfirestopped concealed spaces. A large part of the flooring, including much of that above the third floor level, was wood, and roof construction consisted of composition covering laid over 1⅝-in. tongue and groove sheathing on wood joists on unprotected steel trusses and columns.

Fire Protection

Immediately following the close of the 1948 season, the track's private fire brigade had been laid off to reduce expenses. For the present racing season (opening day,

Based upon reports by the Inglewood Fire Department and the Pacific Fire Rating Bureau.





HOLLYWOOD PARK RACE TRACK

Inglewood, California

Fire May 5-6, 1949

Acme

Fire at the Hollywood Park grandstand, May 5, originated in the club house section at the extreme left of the picture, where it burned undetected in ceiling and wall spaces before breaking into the open. Seven minutes after discovery it had involved the entire 1,250-foot-long roof deck of the grandstand.

May 17), enough men had recently been re-hired to maintain two on duty per eight hour shift. Although this inadequate manpower may or may not have contributed to the extent of damage in this fire, it was certainly insufficient to hold in check a fire of any size pending arrival of the public fire department. Needless to say, the practice of dispensing with the brigade during the closed season was short-sighted economy.

The structure had no sprinkler protection. Central station supervised hourly watchman tours were maintained, numerous standpipes with hose attached, and many fire extinguishers were placed strategically throughout the structure, and yard hydrants adequately supplied from the Los Angeles City water system were well distributed about the track.

The Fire

At 11:11 P.M. a pedestrian noticed smoke coming from the roof of the club house section (see diagram) and telephoned the alarm to the Inglewood Fire Department. At about the same time the watchman was met by dense smoke when he opened a door leading to an anteroom adjoining the passenger elevator shafts. The anteroom was a short flight of stairs above the fourth floor of the club house. The watchman hastened to send the alarm at a box on the fourth floor of the club house, reporting that as he did so he heard the sirens of approaching apparatus. The watchman's alarm was recorded at 11:14 P.M.

Flames were coming from the roof in the vicinity of the elevator shafts when the first apparatus arrived. They spread with extreme rapidity from the club house to other parts of the structure, feeding on wood studding in concealed wall and ceiling spaces, and racing beneath the wood-sheathed roof. Although fire walls would have been impractical in the grandstand,

draft curtains, had they been provided, might have retarded flame spread sufficiently to give firemen a chance. Some conception of the rate of flame travel can be obtained from the experience of two firemen, who in endeavoring to reach a standpipe on the roof were nearly overtaken and just managed to escape.

Within five minutes of the first alarm, water was being directed on the fire by the Inglewood Fire Department, whose five pumpers and aerial ladder were later augmented by two companies from the Los Angeles City Fire Department and one from the County. Despite the 27 hose streams eventually in use, lateral spread could not be halted and practically all of the steel trusses and many of the columns and beams of the superstructure were badly distorted. However, firemen were partially successful in preventing involvement of lower floors.

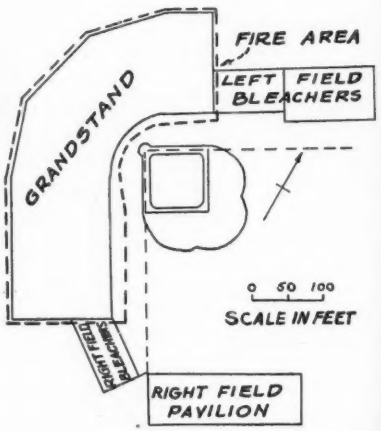
The exact location of the origin of the fire cannot be pin-pointed because of the complete destruction of combustible material in the club house section. Due to the tremendous amount of continuous concealed space above ceilings without sprinklers or draft stops, it is quite possible that the fire started some distance from where it was first seen. It is also possible that it may have smoldered for some time before breaking into the open.

The cause of the fire is likewise a mystery due to the complete destruction of combustible materials in the area where the fire was first discovered. Several theories involving painters' materials, kitchen equipment and elevator motors were all thoroughly investigated and discarded.

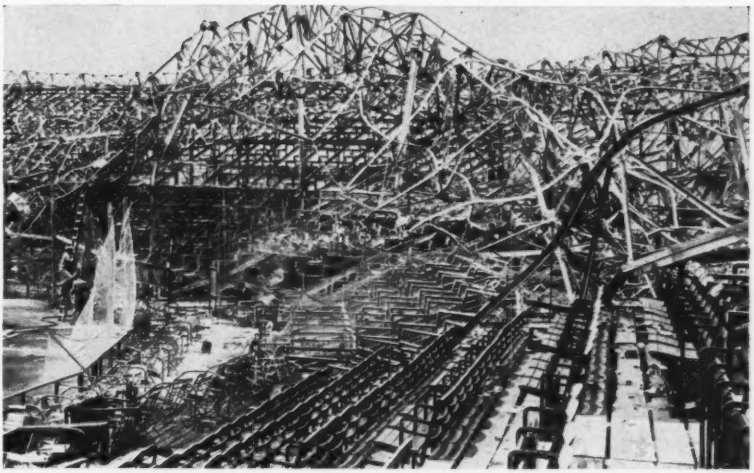
Fort Worth Baseball Park Fire

On May 15, ten days after the Hollywood Park fire (page 71), the grandstand at the home field of the Fort Worth Baseball Club was destroyed. As in the case of its predecessor at the more pretentious California horse track, this fire confirmed the vulnerability of these unprotected steel frame structures supporting large undivided areas of combustible flooring and roof decking.

Seating facilities at La Grave Field consisted of a V-shaped grandstand typical of baseball fields that extended approximately 250 feet along the foul line into right field and as far as third base along the left field foul line. Construction was unprotected steel frame with wood platforms (flooring), wood seats and wood roof deck. Steel framed right and left field bleachers and a covered wooden pavilion in deep right field brought the total capacity to 12,415. Six 2½-inch standpipes, each with 200 feet of 1½-inch hose attached, were installed beneath the stands.



Based upon report submitted by the Fort Worth Fire Department.



Star-Telegram

Wooden flooring, chairs and roof deck were burning fiercely when fire was discovered at 1:14 A.M., May 15, at La Grave Field, Fort Worth, Texas. Indications are that the fire originated in a concession booth beneath the stands.

Following completion of a night game on May 14, attendants had locked up the park and gone home. No watchman was left on the premises. At 1:14 A.M. reflection of fire at the park was noticed by a waitress two blocks away. The alarm was telephoned at once, but here, as at Hollywood Park, delayed detection defeated the firemen before a line could be charged.

Flames spreading before a 20 mph wind had already involved most of the wooden platform, seats and roof deck of the undivided grandstand and were threatening other sections when firemen arrived.

Additional alarms were sounded, bringing a total of 7 engine and 3 ladder companies to the fire, and this force by directing nine 2½-inch lines on the grandstand from four sides did a remarkable job in confining the fire to this area.

Investigation indicated that the fire originated beneath the grandstand at a combustible booth occupied by a soft drink and sandwich concession. Although the cause remains officially unknown, it is believed that a stove used in preparing hamburgers had not been shut off following the game.

Loss has been estimated at $500,000, of which $100,000 was covered by insurance.

Fire In A Fire-Resistive Warehouse

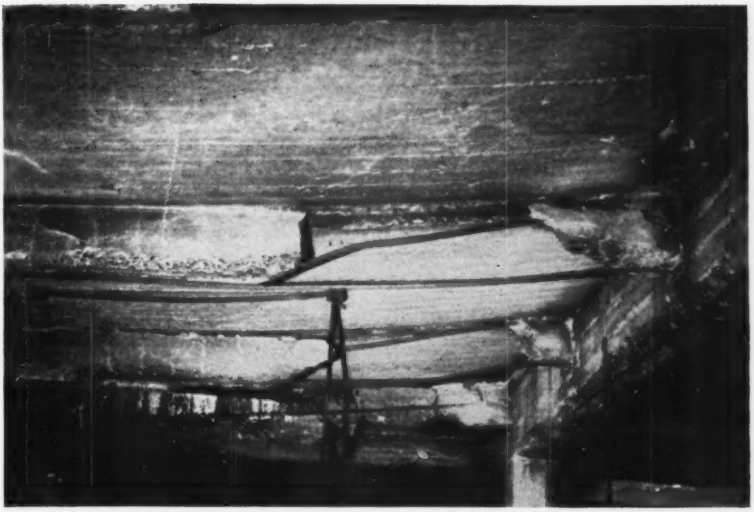
Overconfidence in "fire-resistive construction" continues to be the indirect cause of many disastrous fires. (See Chapter 25, NFPA *Handbook of Fire Protection, Tenth Edition.*) The building at Little Rock, Arkansas, occupied jointly by O'Bannon Brothers Electrical Supply Co. and Refrigeration and Electric Supply Co., met all requirements of the definition of fire-resistive construction, but in a serious fire on March 23 was heavily damaged because the degree of hazard represented by its combustible contents had been completely overlooked.

The 1-story fire-resistive building (21,576 sq. ft. total area) was erected in 1946 and had been kept in excellent repair. Walls were 8-inch hollow tile, brick lined; roof, 4-inch reinforced concrete beams and slabs, and concrete floor. Since, to the owners, a building so constructed seemed immune to fire, sprinklers were considered unnecessary. Overlooked were the numerous wood stud hollow partitions sheathed with wood and combustible fibreboard, wooden storage decks rising eight feet above the floor and covering 20 per cent of the floor area, metal and wood storage cabinets stacked to the ceiling, and the congested storage of appliances packed in excelsior and cardboard cartons.

Delayed alarm transmission was an important factor in this fire. At 9:45 P.M. a member of the firm working late smelled smoke and made a brief inspection. Everything seemed to be in order so he went back to his books. At 10:15 P.M. on leaving for home he was again conscious of smoke, but erroneously attributed the odor to a water cooler motor. Fear of "crying

Based upon report submitted by Arkansas Inspection and Rating Bureau.

The contents of this fire-resistive wholesale house were destroyed and the building itself was heavily damaged. High-piled combustible contents were crammed into an unsprinklered single fire area of 21,576 sq. ft.



After more than four hours of uncontrolled burning of high-piled combustible contents in this large fire-resistive building, roof supports sagged, roof slabs cracked and in some areas reinforcing concrete fell away from steel in supporting members.

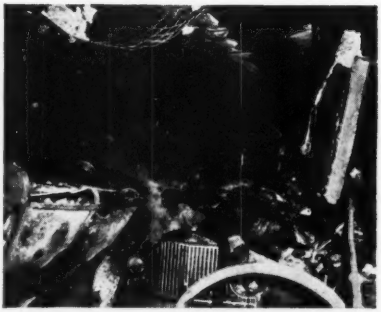
wolf" was his explanation for failure to call the fire department. It was not until 11:45 P.M., two hours after smoke was first detected, that the fire department answered an outsider's alarm. No fire was visible, but smoke was dense, requiring ventilation before entry could be made. It was then that firemen met the first of several obstacles that converted this fire that "could have been extinguished with two hose lines" into a blaze that was not finally extinguished until the following day. Skylights were opened and a wooden door was forced with an axe, but the large metal overhead doors in exterior openings presented a different problem. These were double locked and considerable time was consumed in forcing them up enough to allow the men to gain admittance. Windows were broken open, but metal cabinets prevented men from entering and obstructed hose streams. When entry was finally effected stock was stacked so high and deep and the aisles were so narrow that hose lines could not be maneuvered fast enough to control fire in the highly combustible cardboard cartons and other packing material. To make matters worse, several drums of carbon disulphide, methyl chloride and freon 12 ruptured, releasing vapors which in combination with fire gases affected the eyes, throats and lungs of the men (four were hospitalized). Breathing apparatus was not used, the reason given being that the men would not have been able to see in the dense smoke and fumes had gas masks been worn. Under such punishing conditions it was necessary to evacuate firemen from the building and attempt to reach the inaccessible flames with hose streams directed from outside. The fire burned out of control until 4:00 A.M. and was not finally extinguished until 1:00 P.M., March 25. Loss estimates totaling $256,800 included $36,800 damage to the $100,000 building and $220,000 (practically total) to contents.

Holland Tunnel Fire

On the morning of May 13, fire broke out in a truck proceeding through the eastbound tube of the Holland Tunnel. Before controlled by the combined action of the New York and Jersey City fire departments and the tunnel crew, ten trucks and a 500-ft. section of the reinforced concrete tunnel lining had been destroyed. Loss is estimated at $500,000.

The Holland Tunnel, connecting New York and New Jersey, consists of two parallel 9250 ft. long tubes, each carrying a two-lane 26-ft. wide roadway. Tubes are connected by three companionways for personnel use only. The tunnel is equipped with 6-inch water mains supplied by 4 automatically operated 300 gpm pumps. Standpipe connections (without hose) are installed at frequent intervals and numerous fire extinguishers are located in wall cabinets. A full description of the tunnel and its fire protection was published in the *Quarterly* for July 1926 (Vol. 25, No. 1, page 55). The ventilating system, providing for 42 air changes per hour, was an important factor in the removal of smoke during this fire.

Shortly before 8:30 A.M., May 13, a driver picked up a 16-ton trailer truck in a garage in Jersey City and headed toward New York via the Holland Tunnel. The truck contained 48,536 pounds of carbon disulphide in eighty 55-gallon drums. Tunnel regulations limit carbon disulphide loads to 100 gallons, or 1000 pounds. Truck traffic in the eastbound tube was heavy and moving slowly, with stopping and starting. When about a third of the way through the tunnel during a momentary stop, the driver heard a loud bang and on discovering flames shooting from his truck, left the vehicle without setting the brakes.



Acme

While proceeding through the Holland Tunnel a 16-ton trailer truck loaded with eighty 55-gallon drums of carbon disulphide caught fire. Ten trucks were destroyed and a 500-foot section of the tunnel heavily damaged.

The exploding truck rolled over into the fast lane, passed one truck and stopped parallel to two others loaded with assorted paint products and clorox. Flames quickly involved these vehicles, and containers of linseed oil, turpentine, and bleaching fluid were soon exploding, along with drums of carbon disulphide. Fire also spread to six other trucks immediately behind, including one loaded with clams, one empty, one loaded with tomato juice, one with paper, and another with iron liquor and coal tar. All were demolished. Fortunately, there were no fatalities, although 13 persons were injured or overcome as they fled from the area and into the adjoining westbound tube through a connecting companionway.

The fire occurred at 8:50 A.M., although the first alarm didn't reach the New York Fire Department until 9:13 A.M. In the

interim the tunnel crew had stretched a 1½-inch line and had attempted to tow out the leading truck. First arriving firemen were confronted with ten trucks in flames, heavy concentrations of carbon disulphide, ammonia and chlorine vapors and intermittent explosions. The tunnel ventilating system continued in operation during the fire. In all, eight engine companies, three ladders and 21 pieces of special equipment were used before the fire was finally extinguished.

In view of possible criminal court action the Port of New York Authority has not released further details on this fire at this time.

Chicago Foundry Fire

Delayed alarm transmission continues to be as important a factor in the large loss fires of 1949 as it was in 1948. (See January *Quarterly,* "Large Loss Fires of 1948.") Failure of employees of the Western Material Company to recognize the value of prompt attack by trained fire fighters had an important bearing on the extent of damage at their plant, April 18. Other weaknesses in fire protection which became painfully evident as this fire progressed would not have had opportunity to exert their influence had the fire department been called at once. There can be no relaxation by management in its responsibility to train employees in correct emergency procedure if such disastrous fires are to be averted.

The building involved was one of the foundry group owned by the Hansell

Based upon reports submitted by the Chicago Fire Department and Cook County Inspection Bureau.

Delayed alarm transmission by employees allowed fire on a loading platform to enter this foundry building and spread rapidly over shellacked wooden patterns. Two-thirds of the 30,000 sq. ft. structure was in flames by the time hose streams could be brought into position.

Elcock Company and occupied primarily for storage of a large number of wooden shellacked patterns and iron castings on the high first floor, and for office space in a small second floor section. The Western Material Company leased one-third of the first floor for bagging and storing molding sand. Principal construction features included brick walls, unprotected steel beams and columns, concrete first floor and heavy wood second floor and roof deck. There were no fire walls to subdivide the 30,000 sq. ft. area, stairways were open and no sprinkler or other automatic protection was provided.

On the morning of the fire a box car of molding sand stood beside the wooden loading dock near one end of the 300-foot long building as employees of the Western Material Company prepared to unload and bag the sand in 100-pound paper bags. Three thousand empty bags were stacked in the building just inside the loading dock door. As was customary on cold days an oil-fired salamander had been set up on the loading dock to keep the men warm.

Shortly after 8:10 A.M., the salamander was tipped over by a hand truck and spilled oil burst into flame. The foreman when appraised of the fire was inside telephoning and delayed going to the loading dock until the call was completed. By then the dock was in flames and the men had fled. Although it should have been evident that the fire would enter the building through the open doorway, the door was not closed, the alarm was not given and valuable minutes were wasted as the foreman made a futile attack on the fire with hand extinguishers. The fire department was finally notified at 8:23 A.M. by a second-floor office employee.

On arrival of the fire department flames had entered the building through the loading dock door, had spread rapidly over the paper bags and shellacked patterns in the large undivided building and were coming through the windows on the opposite side. Fire had involved much of the roof in the one-story section and had spread up the open stairway to the small second floor office section.

Additional alarms brought a total of 21 engines, 5 ladder trucks, and miscellaneous other apparatus to the scene, but before the effect of this equipment could be felt, two-thirds of the roof had collapsed and valuable patterns and castings were destroyed. The fact that a small section farthest from the point of origin was saved once this large fire-fighting force was mobilized leads to speculation as to extent of damage had firemen been given those extra 13 minutes at the start when the fire was still confined to the foundry platform.

Loss estimates totaling $558,000 included $225,000 to the building, $200,000 to contents and $133,000 business interruption loss.

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Write for details on how ADT Services may be applied to provide better protection at less cost.

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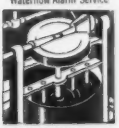
Sprinkler Supervisory and Waterflow Alarm Service

Burglar Alarm Service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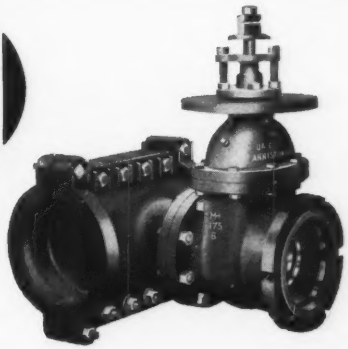

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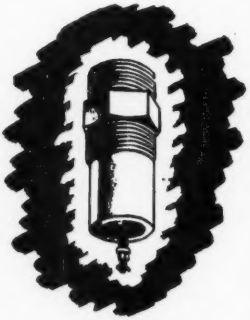

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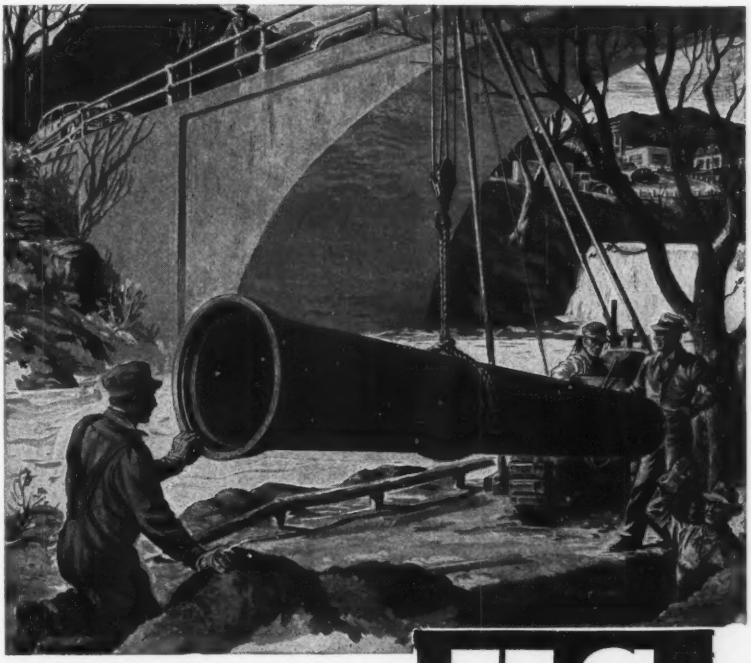

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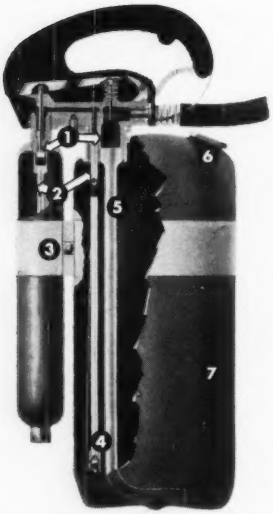

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7 *Lightweight cylinder for ease of carrying.* Pound for pound, the *Kidde* Dry Chemical Extinguisher packs more fire-fighting punch!

8 *Better powder dispersion pattern.* Diffusion baffle in horn gives greater coverage, more effective application. No shut-off valve in horn to trap powder under pressure in hose. No rodding out of hose after use.

9 *Extinguisher tested for operation at —40° F.*

10 *Improved powder and packaging.* Powder specially processed to make it free-flowing; packed in weatherproof containers. 30-pound carton contains three 10-pound cans—for easy refilling of either 20- or 30-pound extinguishers. 50-pound containers also available.

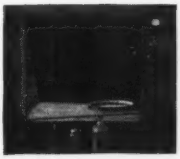
Write for full details

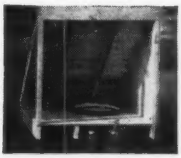
Kidde

The words "Kidde" and "Lux" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.

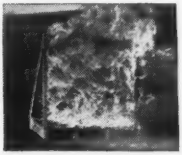
Walter Kidde & Company, Inc., 751 Main Street, Belleville 9, N. J.

TESTS CONFIRM...

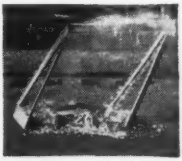




Test structures built of Koppers fire-retardant wood (left) and untreated wood (right) ready for the fire test. Five quarts of kerosene, placed in pans, furnishes fuel for each blaze.



Both structures are quickly enveloped in flame. Treated structure resists fire, but untreated one encourages it, contributes fuel to the fire.



After twenty-two minutes the untreated structure, still burning, is collapsing. Note that in the treated structure, the fire stopped when the fuel burned out.

KOPPERS

KOPPERS PRESSURE-TREATED WOOD

KOPPERS COMPANY, INC.

PITTSBURGH 19, PA.

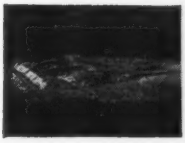
fire retardance of KOPPERS CZC(FR)

Koppers fire-retardant wood is suitable for use as flooring, roofing, sheathing and structural members of industrial buildings, garages, airplane hangars, munitions plants, docks and warehouse buildings, railroad engine houses, and other similar structures. Koppers CZC(FR) treatment has a valuable plus advantage, for it also fortifies the wood against decay and termite attack. Color and paintability are not harmed by the odorless CZC(FR) treatment.

Investigate the possibilities of this new Koppers development. Send for your copy of the booklet, "Koppers Fire-Retardant Wood." Filled with interesting, helpful information.

Right · The treated structure was charred . . . but retained its integrity and strength, as the 800 pound load shows.

Left · Continued burning reduced the untreated structure to ashes.



CENTRAL SPRINKLERS PIONEER AGAIN

with

ALUMINUM VALVE CONSTRUCTION

LIGHT WEIGHT

Six-inch Dry Valve, weighs only 90 lbs.

NON-CORRODIBLE

No Iron or Steel Parts to Rust or Corrode

SMOOTHER, NON-POROUS CASTING

Finer, More Pleasing Appearance

These finer CENTRAL Sprinkler Valves
are now available to you.

For the best in Automatic Sprinkler Protection, now is the time to "Centralize" your needs

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Fourth Street and Cannon Avenue

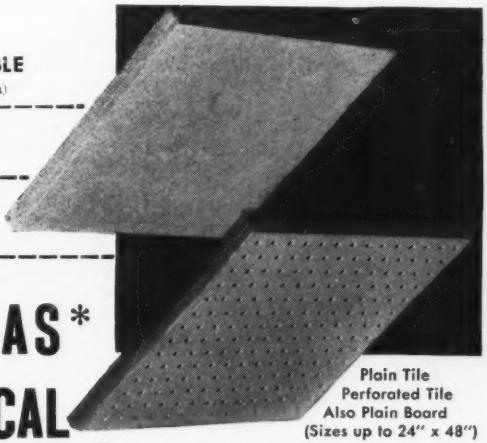
LANSDALE, PENNA.

Representatives in Principal Cities in United States and in Foreign Countries

NONCOMBUSTIBLE
(Fed. Spec. SS-A-118a)

EFFICIENT

LIGHT WEIGHT



Plain Tile
Perforated Tile
Also Plain Board
(Sizes up to 24" x 48")

FIBERGLAS* ACOUSTICAL MATERIALS

Write for your copy of the new manual—"Fiberglas Acoustical Materials" —Fiberglas Standards AC6.C1. Owens - Corning Fiberglas Corporation, Dept. 826, Toledo, Ohio. In Canada: Fiberglas Canada Ltd., Toronto, Ontario.

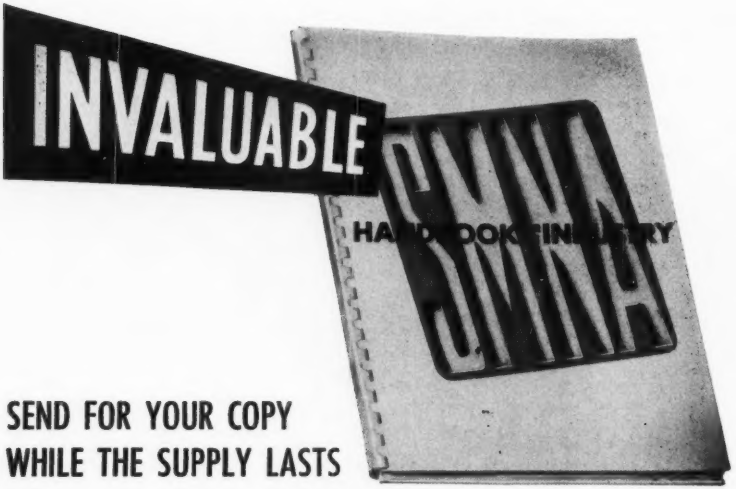
Important Characteristics:

- ★ Noncombustible (Fed. Spec. SS-A-118a)
- ★ High acoustical value
- ★ Light weight
- ★ Dimensionally stable
- ★ Easy maintenance
- ★ Economical—competitively priced
- ★ Ideal for firesafe, mechanically suspended ceilings
- ★ High safety factor in adhesive applications
- ★ Approved applicators in principal cities

*FIBERGLAS is the trademark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with glass fibers.

OWENS-CORNING FIBERGLAS ACOUSTICAL MATERIALS

BUILDING INSULATION - ACOUSTICAL TILE & BOARD - ROOF INSULATION - MEMBRANE FABRIC - ALSO BASIC MATERIALS FOR SIDING, ETC.



**SEND FOR YOUR COPY
WHILE THE SUPPLY LASTS**

This new Manual is the most authoritative and thorough volume ever compiled on the subject of record-protection equipment. An indispensable reference book, well-organized, easy to use. 76 pages of pertinent information concerning the specifications, tests and specific applications of rated safe-industry products; gives aids for measuring fire hazards and record protection needs and other essential data.

Price $1

The layman still needs to be told . . .

—and to have it everlastingly repeated:

1. Forty-three per cent of burned out businesses never re-open their doors!
2. Bad fires can and do occur even in so-called "fire-proof" buildings.
3. Insurance premium savings more than pay for sprinkler installation.

Telling the layman these important things is a job for *all* fire protection men.

Blaw-Knox Fire Protection Systems include Standard Wet or Dry Pipe Systems, Fog Nozzles for Fixed Installations, Thermostatically Controlled and Supervised Deluge Systems, and special fittings for special conditions.*

**Listed by Underwriters' Laboratories, Inc., and approved by Factory Mutual Laboratories.*

BLAW-KNOX
SPRINKLER DIVISION
OF BLAW-KNOX CONSTRUCTION COMPANY
829 BEAVER AVENUE, N. S., PITTSBURGH 12, PA.
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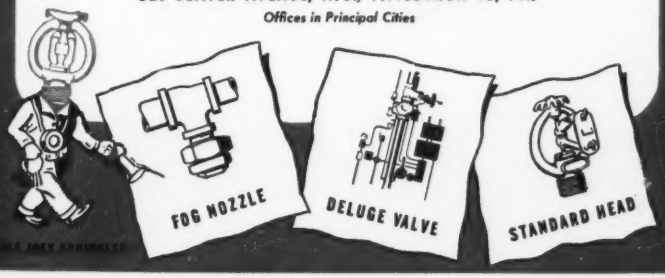

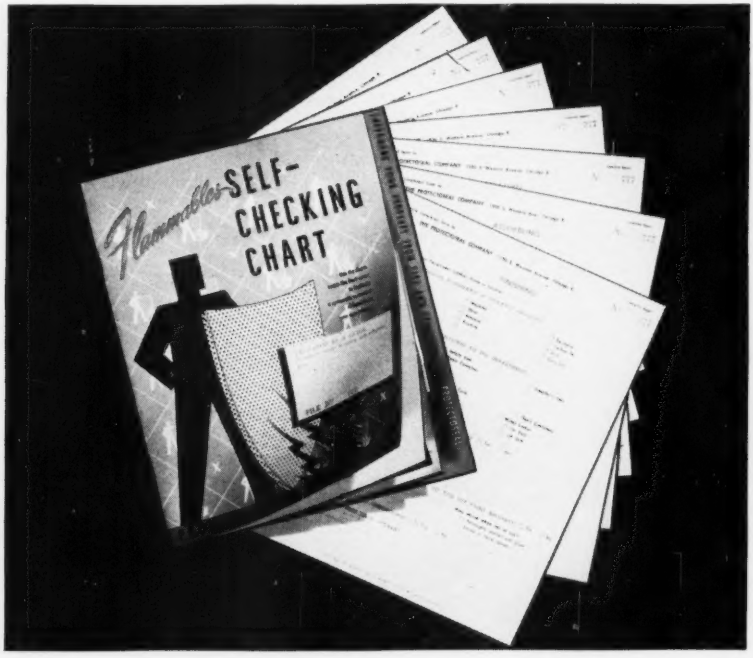

Announcing *Flammable* SELF - CHECKING CHART

(complimentary copy at your request)

Just off the press, yet this new SELF-CHECKING CHART has already won gratifying praise from professional people who have seen it — from management people who have used it. Designed to help industry help itself to greater fire safety, this new technique of self-survey makes for easier and more accurate check-up on flammable hazards.

A complete set of easy-to-use departmental charts is contained in the pocket of this attractive 12-page booklet filled with interesting and useful FIRE FACTS. We shall be happy to send a copy for your personal use.

Why not furnish us a list of firms you contact who you feel might find this material helpful? We will send each of them a copy of this new SELF-CHECKING CHART and indicate that it is sent with *your* compliments.

THE PROTECTOSEAL COMPANY

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In The Background Till Fire Strikes

Fits in smoothly with the most modern interiors. Barely visible, but ready at a second's warning to spring into action. Viking Flush Type Sprinkler Heads offer great *dependability*, plus true functional design. Get all details today from the *Viking* representative in your neighborhood.

THE VIKING FLUSH TYPE SPRINKLER HEAD

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THE VIKING CORPORATION
HASTINGS, MICHIGAN

VAPORIZING LIQUID

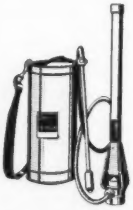
The all-purpose extinguishers effective on almost every kind of fire. Safe on electrical fires, too! Hand or pressure operation.

CHEMICAL FOAM

2½ gal. size produces about 22 gals. of fast-acting foam. Ideal for flammable liquid hazards. Also 10 gal. and 40 gal. (above) wheeled units, and systems.

CARTRIDGE-OPERATED

Eliminates annual recharging. For fires in wood, paper, textiles. Shoots water or antifreeze solution. 2½ gal. size.



AIR FOAM

Couple Playpipe to hose line. Every 19 gals. of water and 1 gal. of PYRENE Foam Compound yield 350 gals. of foam! For ordinary combustibles and flammable liquids.

SODA-ACID

Standard protection for ordinary combustibles. Shoots a steady 40 ft. stream. 2½ gal. size. For offices, factories, stores. Also 40 gal. wheeled units.

Pyrene has what it takes

Name any kind of fire hazard—there's a PYRENE* to guard it! Jobbers and service depots in all leading cities are ready to supply PYRENE fire extinguishers and service.

*T. M. Reg. U. S. Pat. Off.

Pyrene FIRE EXTINGUISHERS

PYRENE MANUFACTURING COMPANY

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Affiliated with C-O-Two Fire Equipment Co.

Only the DETECT-A-FIRE* signals instantly at danger point of surrounding air... is explosion-proof ...repeatable

Listed by Underwriters' Laboratories, Inc., for use in hazardous locations.

BECAUSE . . . activating stainless steel shell in contact with air responds with no lag; hermetically seals and mechanically protects internal mechanism

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DETECT-A-FIRE*

**Listed By Underwriters' Laboratories, Inc.*

Positive Fixed-Temperature Response Under *All* Conditions

SENSITIVE... *But Only To Heat*

BE SAFE! Don't fail to investigate this amazing new development in fire detection devices for use with fire alarm and extinguishing systems. Mail coupon for free bulletin.

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Company.....

Street.....

City..... *Zone*..... *State*.....

FENWAL INCORPORATED, 30 PLEASANT STREET, ASHLAND, MASSACHUSETTS

"Eternal Vigilance"

—THE PRICE OF SECURITY!

WHETHER IT BE NATIONAL OR INDIVIDUAL PERFORMANCE . . . SECURITY IS ACHIEVED ONLY BY THE EVER-ALERT, EVER-CAPABLE AND EVER-DEPENDABLE!

All of these requisites for SECURITY against loss of life and property by fire are provided through the "ETERNAL VIGILANCE" of

STAR AUTOMATIC SPRINKLERS

Automatic Sprinklers
Corrosion-Proof Sprinklers
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Automatic Releases
Standard Wet Pipe Systems
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Deluge Systems
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Pre-Action Systems

Star Automatic Sprinklers and Fire Protection Devices bear approval of all Insurance Authorities having jurisdiction and various Governmental Agencies.

Economy in installation cost and maintenance has dictated the consistent policy of Star Sprinkler Corporation in distributing its Fire Protection Devices through local licensed contractors who have had a lifetime of experience in the installation of automatic sprinkler systems. Operating throughout the United States, Canada and South America, Star licensees, due to their strategic locations, can render instant service. Write us for name and address of Star licensed contractor nearest your location.

STAR SPRINKLER CORP.

Westmoreland and Collins Sts. — Philadelphia, Pa.

3-inch size shown above. To install simply drill hole in pipe.

CENTRAL STATION SIGNALS, INC.

Model PRS

Waterflow Alarm Device was approved by the Underwriters' Laboratories, Inc., last year and has proven in hundreds of installations to be the ideal alarm device for sprinkler systems.

- **Made in all sizes from 2½" to 8"**
- **It is positive in operation**
- **Has instantly recycling pneumatic retarding device which prevents false alarms**
- **Has enclosed electrical contacts for 15 amp, 125 volts AC and ½ amp, 125 volts DC**
- **Relay may be provided for any electrical load**
- **Can be furnished in open or closed circuit**

By installing this most economical alarm device, you will know instantly where the water is flowing. Many plants are having them installed on each floor or in each section. They save water damage.

This device can also be obtained as Model PRT, a coded waterflow transmitter from which signals are received on a punch register and single stroke gong. Practically any number can be installed on a two-wire system, thus resulting in considerable savings on wiring.

WE SOLICIT YOUR INQUIRIES

CENTRAL STATION SIGNALS, INC.

Manufacturers of all kinds of approved devices used in Central Station Systems or Class 'A' or Class 'B' Proprietary Fire Alarm Systems, either automatic or manual.

71 WEST 23rd STREET -:- NEW YORK 10, N. Y.

FOR EVERY *Industrial*

FIRE PROTECTION and WATER STORAGE NEED—

200,000-gal. tank in two 100,000-gal. sections, with 200,000-gal. standpipe at base, for fire protection at large assembly plant.

PITTSBURGH · DES MOINES
ELEVATED STEEL TANKS

Your requirements for standard or special Elevated Steel Tanks can be satisfied in every particular by Pittsburgh-Des Moines! Let our Engineering Department work with you in determining the design best suited to your needs in type, capacity, and performance—for fire protection—for storage of water or other liquids—or for treatment, mixing or settling tanks in any manufacturing process. Write, phone or wire for a prompt consultation.

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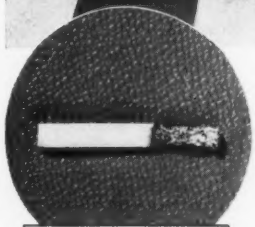
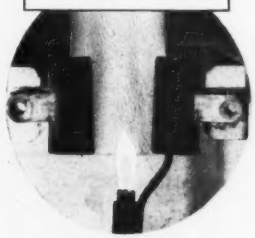
Furniture by Ficks Reed Company, Cincinnati, Ohio



Flame tests and cigarette tests demonstrate fire-resistant qualities of Tolex.



Of sterling worth, is what our own experience teaches.
—Tennyson

You can be sure of greater safety in places of public gathering . . . where fire-resistant TOLEX plastic leathercloth is used for upholstery, wall coverings and decoration.

New York City, Boston and other large cities have certified TOLEX to be FIRE RESISTANT.

In your community—a greater use of Tolex fire-resistant upholstery in hotels, bars, restaurants, theaters, auditoriums and other public buildings will help to cut down fire hazards.

Consulting Service available to you! Without charge or obligation, we will gladly send our technical representative to discuss fire-resistant leathercloth specifications and test methods with fire marshals, fire departments, fire prevention boards or underwriters. Write to . . . Textileather Corporation, Toledo, Ohio.

35 Years of Leadership in Leathercloth

**Reg. U. S. Pat. Off.*

EASIER FIRE FIGHTING FOR YOUR EMPLOYEES!

with

Randolph

Trigger-Touch Carbon Dioxide Fire Extinguishers

Your employees are your *real* fire-fighters . . . and the fire extinguisher is their most powerful weapon. That's why it's important that you eliminate cumbersome, antiquated extinguishers . . . provide them with easy-to-use equipment.

Just ONE HAND snaps the Randolph Extinguisher from its bracket . . . one trigger-touch sends clouds of penetrating, snowy carbon dioxide into the fire . . . stops the most stubborn blaze in *split-seconds!*

With no valves or nozzles to adjust, Randolph Extinguishers are PANIC-PROOF — get the employee to the blaze before it spreads. A non-toxic, odorless gas, carbon dioxide does not damage equipment or conduct electricity. It leaves no stain or liquid; will not freeze or deteriorate.

All Sizes . . . Underwriters Approved

Randolph Trigger-Touch Extinguishers are available in 2, 4, 10, 15 and the big 25 lb. size on wheels . . . every unit approved by Underwriters' Laboratories. Mobilize *your* first-aid fire defense now! For complete fire protection facts or test demonstrations, write . . .

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A Half Century of
ADHERENCE TO THE HIGHEST IDEALS OF
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GLOBE APPROVED DEVICES
Now Provide a Special Purpose
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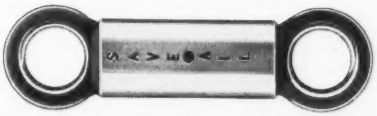

SAVEALL CHEMICAL FUSIBLE LINK
For use in connection with automatic closing devices for doors, windows, dampers and other automatic devices requiring fusible links. For service where the normal ambient temperature does not exceed 100° F.

"A GLOBE INSTALLATION GUARANTEES Commercial, Industrial and Institutional Life Against the Exigencies of Fire."

They Pay for Themselves

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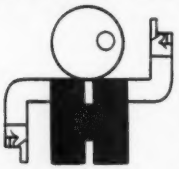
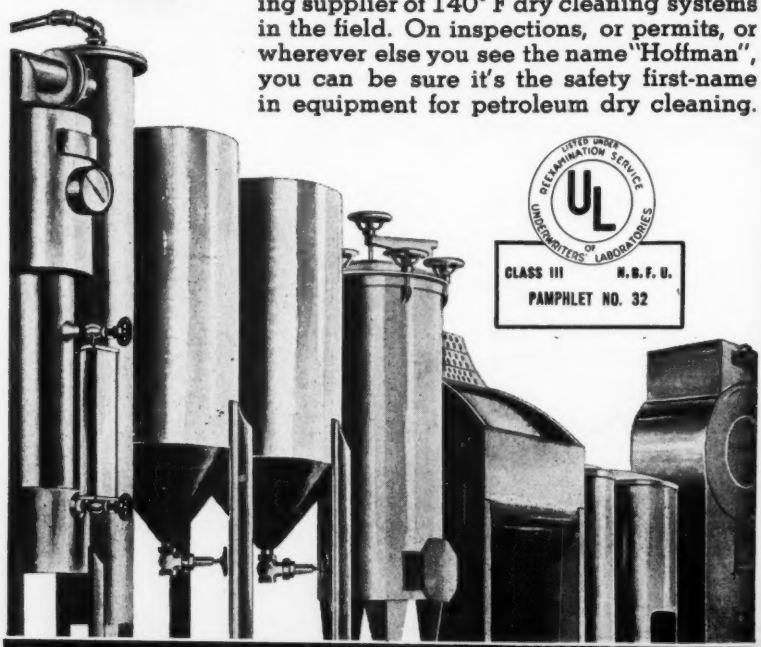
Automatic Sprinkler Co.
2035 WASHINGTON AVENUE
Philadelphia 46, Pa.
SALES OFFICES IN PRINCIPAL CITIES

PROVED by a 13-Year CLEAR LOSS RECORD

HOFFMAN 140-F UNITS FOR SAFE DRY CLEANING



Year after year, the safety of commercial dry cleaning with 140° flash-point, petroleum solvent has been proved by Hoffman equipment. Hoffman originated the process in 1935 and, ever since, has been the leading supplier of 140° F dry cleaning systems in the field. On inspections, or permits, or wherever else you see the name "Hoffman", you can be sure it's the safety first-name in equipment for petroleum dry cleaning.



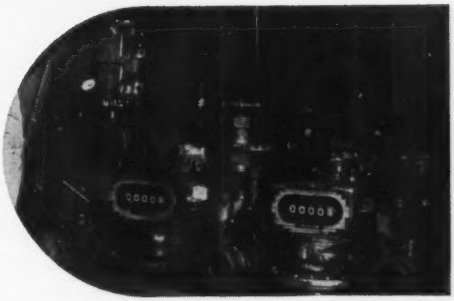
U. S. HOFFMAN MACHINERY CORPORATION
105 Fourth Ave., New York 3, N.Y.
DRY CLEANING, LAUNDRY & GARMENT PRESSING EQUIPMENT

STANDARD OF INDIANA

Uses

S&J

Safety Valves



Standard Oil Company of Indiana is one of the major marketers of petroleum products that equip certain of their truck tanks with S. & J. Internal Hydraulic Safety Valves, to give maximum protection to the public, their drivers, equipment and product while on public highways. S.&J. Hydraulic Internal Safety Valves are located inside each truck tank compartment and are normally in a closed position. In the event of an accident, even one which tears the steel discharge lines from the tank, these Internal Safety Valves preclude spillage of gasoline. Should a carelessly tossed match or cigarette cause a fire while the tank truck is being unloaded, a fusible plug melts and releases the hydraulic pressure, and the safety valves close automatically and stop the flow of fuel without the driver having to expose himself to any hazard. Yes, that's the type of protection provided by petroleum marketers who make SAFETY an important aspect of their operations.

SHAND & JURS CO.

BERKELEY, CALIFORNIA

NEW YORK CHICAGO HOUSTON LOS ANGELES SEATTLE

SHAND & JURS

NEW CRASH RESCUE TRUCK THROWS 4800 GALLON-PER-MINUTE

FogFOAM "Blizzard" ON AIRPLANE FIRES

In the photograph above, you see a "blizzard" of FogFOAM being discharged on a severe gasoline fire around a plane during a drill. A wide path for rescue operations was immediately created between the plane and crash truck.

Passengers, whose lives might otherwise be lost, can now be rescued within seconds, in plane crashes at airports, by means of a new development — Rockwood FogFOAM.

Rockwood FogFOAM Systems for both new and old crash-rescue fire trucks have proved that they can knock out such fires — all in a matter of seconds. They will save lives that could not be saved with old style crash fire fighting equipment.

The Rockwood FogFOAM System is shown in action here on a remarkable new type of crash-rescue truck which is now in service in three of the world's leading airports, located in the New York area — LaGuardia, New International and Newark.

This truck embodies the requirements for crash-rescue operations by the management of these airports.

This latest truck was designed and built by Maxim Motor Company on a Walter four wheel drive chassis. The FogFOAM System for the truck was designed and manufactured by Rockwood Sprinkler Company. If you are planning a new crash-rescue truck or revamping an old one, specify a Rockwood FogFOAM System. Write for specifications.

Note how FogFOAM Screens on turret nozzles (bottom) can be quickly changed to Foam Shapers (top) which throw solid foam streams. Same nozzles will discharge WaterFOG.

ROCKWOOD

ROCKWOOD SPRINKLER COMPANY

56 HARLOW STREET WORCESTER 5, MASSACHUSETTS

Specialists in Fire Protection Engineering, Equipment and Installation since 1907

UL

Listed by:
UNDERWRITERS' LABORATORIES

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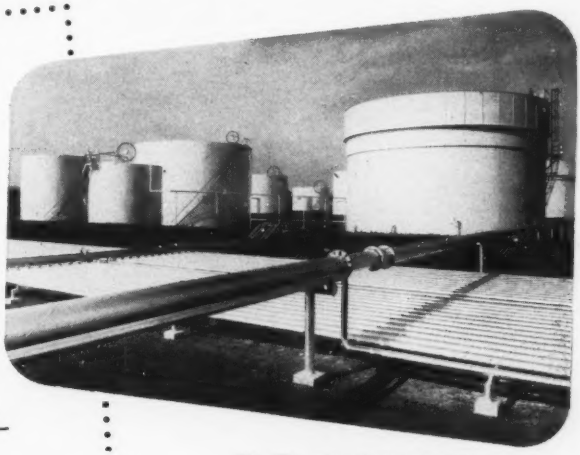


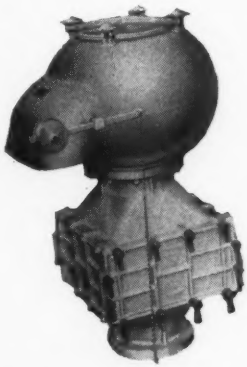
Approved by:
U.S. COAST GUARD, U.S. MARITIME COMMISSION, U.S. NAVY, AMERICAN BUREAU OF SHIPPING, LLOYD'S BUREAU OF SHIPPING

PROVED
IN SERVICE...
APPROVED
BY SAFETY AUTHORITIES

The measure of a safety device can best be made by the job it has done when it was needed. Safety authorities can test and make known what such devices will do under preconceived conditions but field results are as important as laboratory tests.

The field results with all VAREC Equipment have been outstanding. This speaks equally well for the quality of the equipment and the competence of the engineers who selected it. Its quality stems from an organization who for over twenty years have specialized in the manufacture of venting, gauging and other tank equipment.

With this record and the approval of safety authorities, VAREC Equipment guarantees dependable tank protection.



"VAREC" *approved* CONSERVATION VENT UNIT—FIG. NO. 58A—
Consists of Conservation Vent Valve with inside Flame Snuffer and Entrainment Separator Flame Arrester.

PROVED and APPROVED
"Varec"

THE VAPOR RECOVERY SYSTEMS COMPANY
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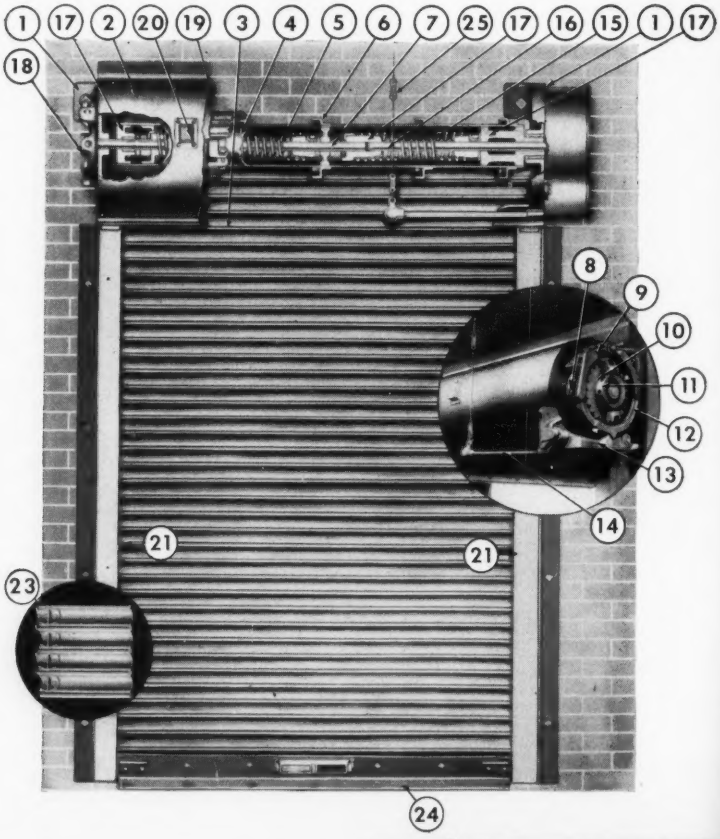
CABLE ADDRESS: VAREC COMPTON (ALL CODES)

Doors Feature 25-Point Fire Safety

Extra safety and efficiency are assured in every detail of "Akbar" Steel Rolling Fire Doors, product of The Kinnear Manufacturing Company, Columbus 16, Ohio.

Labeled by Underwriters' Laboratories, Inc., these automatic fire doors block drafts and spreading flames, confine losses to smaller areas. A starting spring assures quick, positive action when fire threatens. For the safety of building occupants their downward speed is controlled, and they may be re-opened for emergency exit. The doors are coiled overhead when not in use. Equipped for daily use, they may even be motor operated, if desired. Built to fit any opening, in old or new buildings. Write for details on 25 safety and efficiency features of Kinnear "Akbar" Steel Rolling Fire Doors.



THE KINNEAR MANUFACTURING CO.

2250-70 Fields Ave., Columbus 16, Ohio
1742 Yosemite Avenue, San Francisco 24, California
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Saving Ways in Doorways
KINNEAR
ROLLING DOORS

FOR FLAMMABLE LIQUID AND ELECTRICAL FIRES

PIONEERS OF DRY CHEMICAL ANSUL FIRE EXTINGUISHING EQUIPMENT

DRY CHEMICAL

FIRE EXTINGUISHERS

ARE YOUR *BEST* PROTECTION

...and most economical, too! Tests conducted by impartial, nationally recognized approval laboratories have proved the superiority of Ansul Dry Chemical Fire Extinguishers on *Flammable Liquid Fires.*

In addition, Ansul Fire Extinguishers provide greater safety for the operator. The stream of Ansul Dry Chemical forms a protective screen safeguarding him against radiant heat.

More and more industrial plants, transportation companies, oil companies, etc. are switching to Ansul Extinguishers as their first line of fire defense. There is a reason.

Get the facts. Send for your copy of File No. 435. You'll also receive our latest literature together with comparative rating charts for the various types of fire extinguishers.

- Safe for use on electrical fires, too! Even high voltages are not conducted by dry chemical stream.
- Can be recharged at scene of fire furnishing continuing protection.
- Annual recharging is not necessary. Low maintenance costs.
- Longer range stream of dry chemical is effective in winds and drafts.
- Ansul Dry Chemical is non-abrasive, non-corrosive, non-toxic.
- Listed and Approved by Underwriters Laboratories and Factory Mutual Laboratories.

ANSUL CHEMICAL COMPANY

FIRE EXTINGUISHER DIVISION, MARINETTE, WISCONSIN

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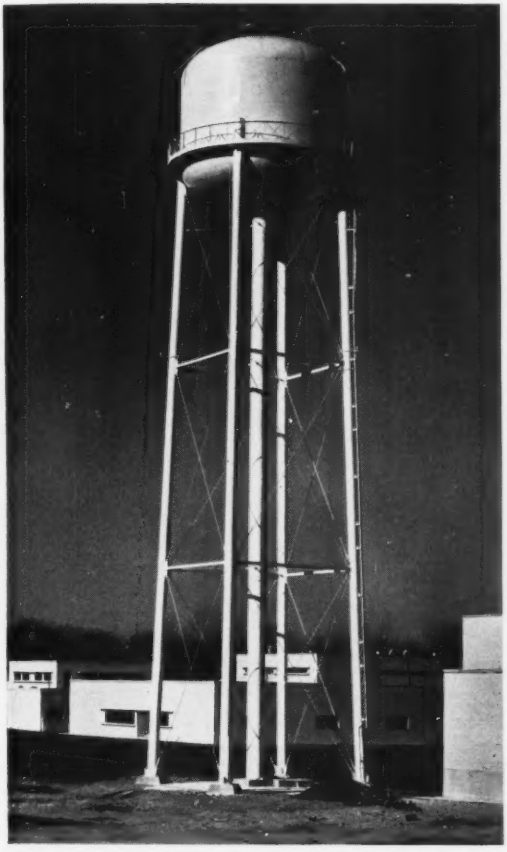
FOR FIRE PROTECTION



This 100,000-gal. Horton elevated steel tank maintains gravity water pressure in the automatic sprinkler system at G. D. Searle & Company's new plant at Skokie, Ill. The sprinkler system protects practically the entire floor area from fire.

The primary water supply for the sprinkler system is taken from a city water main and delivered at the proper pressure by a booster pump. The 100,000-gal. Horton ellipsoidal-bottom elevated tank, 100 ft. to the bottom, provides the secondary supply.

G. D. Searle & Company, manufacturers of pharmaceutical specialties, celebrated its 60th anniversary in 1948. Searle products are distributed through the customary drug channels, wholesalers, retailers, chain stores, and hospitals.

Write our nearest office for information on tank installations. State capacity, height to bottom and location where tank is to be erected.

CHICAGO BRIDGE & IRON COMPANY

CLEVELAND	CHICAGO	BIRMINGHAM	NEW YORK
HAVANA	DETROIT	ATLANTA	PHILADELPHIA
HOUSTON	TULSA	LOS ANGELES	SAN FRANCISCO
CARACAS	BOSTON	SEATTLE	SALT LAKE CITY

Plants at Chicago, Birmingham, Salt Lake City and Greenville, Pa.

"Automatic" Sprinklers . . . A Vital Business Economy for Industry the World Over

ARE you in a position to definitely measure the over-all cost of destruction, should fire reduce your plant or property to a shambles of twisted steel or broken concrete? We doubt it, for fire loss represents considerably more than is visible in the destruction of buildings, equipment and records. It means the interruption of production and service, the reduction of assets and increased liabilities. It means temporary and perhaps permanent loss of customers. In short, it could well mean the financial ruin of your entire business enterprise.

On the brighter side of this picture of fire destruction stand "Automatic" Sprinklers, industry's most effective weapon against fire. For, "Automatic" Sprinkler systems are super-sensitive to the very indication of flame. They make the fire extinguish itself, even before it can make headway. And, on the financial side, "Automatic" Sprinklers, like any other capital asset, can be amortized over a given period of years, with their initial cost ultimately taken as an operating expense.

You and every other executive with an appreciation of business economy must not overlook the importance of fire safety with "Automatic" Sprinklers, *an important investment today . . . perhaps welcomed protection tomorrow.*

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA
YOUNGSTOWN 1, OHIO

"Automatic" Sprinkler
FOR INVESTMENT PROTECTION
DEVELOPMENT · ENGINEERING MANUFACTURE · INSTALLATION

WHY CITIES PREFER GAMEWELL

2 Reasons are—Economy and Dependability

Many Gamewell fire alarm boxes still in use have service records exceeding 70 years, and — Obsolescence, due to the production of later models affording greater protection, not deterioration, is generally the cause of retiring Gamewell boxes from service.

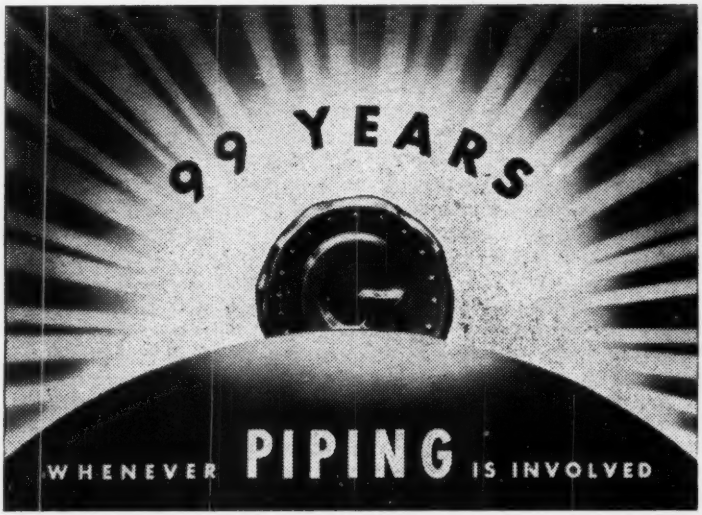
Gamewell Three-Fold Fire Alarm Box

The Standard for Municipal Service

For the protection of the values at risk — human life, property, business and income — adequate fire alarm box distribution is a sound investment.

THE GAMEWELL COMPANY

Newton Upper Falls 64 - Massachusetts



Pioneers in Fire Protection

Pioneers in the field of fire protection, from perforated piping systems to the invention of the first successful automatic sprinkler head in 1882, Grinnell, through research and development, has constantly contributed to the steady advancement of automatic fire protection.

Today, there is a type of Grinnell System to meet practically every fire protection need. Complete information relative to their application to any particular risk is available for the asking from any of our offices throughout the country. Grinnell Company, Inc., Providence 1, R. I.

GRINNELL SYSTEMS

For Protection Against Fire